Commercial Fisheries Abstracts

a monthly summary of important developments for the fishery industries

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Vol. 12 No. 4 April 1959

Fish and Wildlife Service
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Washington D. C.

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DEPARTMENT OF THE INTERIOR
FRED A. SEATON, SECRETARY

FISH AND WILDLIFE SERVICE
ARNIE J. SUOMELA, COMMISSIONER

Commercial Fisheries Abstracts

DIVISION OF INDUSTRIAL RESEARCH AND SERVICES
BUREAU OF COMMERCIAL FISHERIES

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Following is a brief outline of this filing system. The numbers apply to the first digit appearing on each card. For the meaning of subsequent digits, please see the above described leaflet.

0 General and theoretical	3 Preserved fish	7 Analytical Methods
1 Fish by species	4 Oils	8 Composition
2 Fresh fish	5 Vitamins	9 Miscellaneous
	6 Fishery byproducts	

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget November 23, 1956.

1.81 OBSERVATIONS ON COMPOSITION OF OYSTERS

Fieger, E. A.; Novak, A. F.; and Bailey, M. E. (Louisiana State University); Friedrichs, A. V. and St. Amant, Lyle (Louisiana Wild Life and Fisheries Commission)
Seafood Merchandising 1958 Annual Review Number 18, 26, 27 (November 30, 1958)

This is an abridged version of a detailed report by the same authors on the composition of Gulf oysters as influenced by seasonal variation and geographical factors.

Summary of findings. -- A sharp decrease in glycogen content is responsible for oysters becoming thin and watery in late summer and early fall.

The chloride content of oyster meats parallels the salinity of the water from which the oysters are taken.

Oyster quality can be measured by a "Condition Index," a determination of the ratio between the dry weight of the meat and the volume of the cavity of the shell.

$$\text{Condition index} = \frac{100 \times \text{dry weight in grams}}{\text{Volume of cavity in milliliters}}$$

Difference in salinity has a slight effect on the thiamine, riboflavin, pantothenic acid, and pyridoxine content, more effect on niacin content.

Average content of various nutrients from high and low salinity areas

	High salinity Area %	Low salinity Area %
Glycogen	1.28	0.76
Fat	0.89	0.79
Protein	10.71	9.50
pH	5.96	6.00
Dry matter	18.02	15.94
NaCl content of meats	1.10	0.84
NaCl content of sea water	2.22	1.28

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Reprinted in part

2.1121 FISHING WITH THE SOUTH AFRICAN PURSED LAMPARA

Du Plessis, C. G. (Division of Fisheries, Department of Commerce and Industries, Cape Town, South Africa)
World Fishing 7, 57, 58 (March 1958)

The fishing method that makes use of the South African pursed lampara net has been in use for about 15 years. The development of synthetic fiber netting, more efficient winching systems, and craft of greater carrying capacity have influenced both the evolution of the gear and the method of operation.

The drawing reproduced (not to scale) (see over) shows a typical lampara net made of marlon, a material composed of a mixture of nylon and vinylon, that is used in the pilchard, maasbanker, and mackerel fisheries.

The net is seamed in about 170 fathoms in the upper or cork line and about 145 fathoms in the lower or lead line. The netting is $1\frac{1}{2}$-inch mesh throughout and comprises a set of panels that are of equal width top and bottom and of equal width on either side.

To create the curvature, the inner side of each panel is reduced by sealing or tucking in each fifth or sixth mesh to match the depth of the meshes on the outside of the adjoining panel. This procedure is followed throughout each wing, with the result that the bottom of the net lies straight, yet it tapers toward the end panel.

The corks are attached directly to a synthetic rope 5/8 inch in diameter and the leads to a synthetic rope $\frac{1}{2}$ inch in diameter. Approximately 1,000 5-inch corks are used for the bag and shoulders, and from 750 to 1,000 4-inch corks for the wings.

Two 80-fathom hauling lines of manila rope 3 inches in circumference are shackled to the tongue, which is the deepest portion of the bag where about 60 meshes are bunched together to cover an area not more than 18 inches wide. A strop about 2 feet in length with a swivel at each end is attached to the lead line of the tongue, and the hauling lines are attached to these swivels. Below

(over)

ABSTRACTER: Kathryn L. Osterhaug

2.00 CHEMICAL INDICES OF DECOMPOSITION IN COD

Hillig, Fred; Shelton, L. R., Jr.; Loughrey, J. H.; and Eisner, Jerome (Food and Drug Administration, Department of Health, Education, and Welfare, Washington 25, D. C.)
Journal of the Association of Official Agricultural Chemists 41, 763-776 (November 1958)

Eight methods that showed promise of being useful for detecting decomposition in raw pelagic fish were used on samples of cod in various stages of decomposition. The determinations were (1) volatile acid number, (2) formic acid, (3) acetic acid, (4) succinic acid, (5) ethyl alcohol, (6) trimethylamine, (7) histamine, and (8) volatile bases and volatile amines.

Methods. --The procedures for the first seven methods have been published previously. The volatile bases and volatile amines determination is essentially the following: An aqueous extract is made from fish tissue, and one-half of this volume is made alkaline and steam distilled. One aliquot of this distillate is titrated with standard acid to give the concentration of volatile bases. Another aliquot is oxidized with 0.05 N $KMnO_4$. The volume of 0.05 N $KMnO_4$ used represents the volatile amines and neutral compounds in the distillate. The second half of the aqueous extract is made acid and steam distilled, a $Ca(OH)_2$ trap being used to take out the volatile acid. An aliquot of this distillate is oxidized with a volume of 0.05 N $KMnO_4$ and represents that required to oxidize volatile neutral compounds.

The volume of 0.05 N $KMnO_4$ (amines + neutrals) minus volume of 0.05 N $KMnO_4$ (neutrals) equals volume of 0.05 N $KMnO_4$ (amines).

Fish were obtained directly from the boats: the oldest fish were only 24 hours old. The fish were held under the following conditions:

(over)

ABSTRACTER: Herman S. Groninger

2.1471 IS "BANG UP" BANG ON?

Dickson, W. (Scottish Home Department Marine Laboratory, Torry, Aberdeen, Scotland)
World Fishing 7, 39-40 (March 1958)

The Germans use a method for handling their trawls on large trawlers that is different from the usual practice, which was lucidly described in the recent series on the Granton Trawl in World Fishing. Their "bang up" method as it has come to be known, is not so widely understood as it might be. The essentials of the method are that the forward part of the lower wings is cut away so that the ground rope becomes shorter than the distance between the gallows; thus, by heaving on its ends, the trawlermen can, in one movement, lift the ground rope clear of the rail and drop it bodily overboard. The ground rope is usually armored with bobbins for the whole of its length.

The method can be more readily understood by putting the cart before the horse and describing the hauling procedure first. There is nothing different until the end of the sweep wire is reached except that instead of a Kelly's eye on the otterboard backstrops, a bow shackle is used, and this is unscrewed as the sweep wire is hauled. At the end of the sweep wire is a Dan Leno butterfly rigged as shown in figure 4 (see over) with 6 feet of heavy chain and a Kelly's eye attached to the lower arm. When the butterfly is hooked up to the gallows, the end of the sweep wire can be connected to the pennant on the butterfly, either simply by shackles as shown or by a G hook and split-link arrangement. The lower leg can now be heaved through the Kelly's eye on the end of the chain until the bobbins come up level with the rail, from where they can be lowered on deck as the vessel rolls. The headline and upper legs hang slack, and the net is gathered to the waist of the ship for hauling. Sometimes a rope for recovering the headline is connected between the midpoints of headline and ground rope. No leach lines are used. Very often a pair of pony doors is used instead of the Dan Leno butterflies, with the chain and Kelly's eye attached to the lower rear edge and the top leg to the upper rear edge. There are other variations of the theme too, such as the introduction of Dan Leno bobbins in front of the butterflies. No special mention need be made of shooting procedure because it follows understandably enough from the above.

(over)

ABSTRACTER: Kathryn L. Osterhaug

COMPOSITION OF OYSTERS

SPOILAGE PRODUCTS OF COD

PURSED LAMPARA NETS

GERMAN METHOD OF TRAWLING

2.00

1. Eviscerated cod, commercially iced.
2. Eviscerated cod, uniced.
3. Whole cod, held in 76° F. room overnight, eviscerated, and then iced.

Results and discussion.--Heavily iced fish reached organoleptic class 1 (almost complete lack of odor or only slight fishy odor; eyes are slightly dull, flesh is somewhat soft and lacking in resiliency, and gills are red and slightly slimy) after 4 days and could be kept as long as 12 days. There was no day-by-day significant increase in any of the indices until the fish reached the stage at which they were no longer fit for human consumption. At this time there was a several-fold increase in most of the indices. Formic acid was not found until the fish had reached organoleptic class 2 (eyes are dull, and gills are lighter in color and quite slimy; flesh is moderately soft, and infiltration of hemolyzed blood into the tissue appears; and an odor is usually present, which is not intense but is persistent). Histamine was detected only in a few samples in advanced stages of decomposition. The quantities of aldehydes and ketones varied so much that this determination was considered useless for detecting decomposed fish.

Decomposition in uniced fish proceeded rapidly. The chemical indices were in the same ranges as were those found for heavily iced fish in each decomposition class.

The ungutted fish that were allowed to stand at a temperature of 76° F. overnight and then were gutted and iced reached classes 2 and 3 (eyes are sunken, flesh is quite soft and mushy, gills are very slimy and yellowish-gray, and odor is intense) in 10 to 12 days.

A study of the individual analyses indicated that volatile acid number, formic and acetic acids, volatile bases, volatile amines, and trimethylamine show the highest degree of correlation with organoleptic judgment, whereas succinic acid and alcohol show less correlation.

2.1471

Fig. 1. An impression of the whole length of bobbin groundrope coming over the rail at once as it is heaved tight between the gallows.

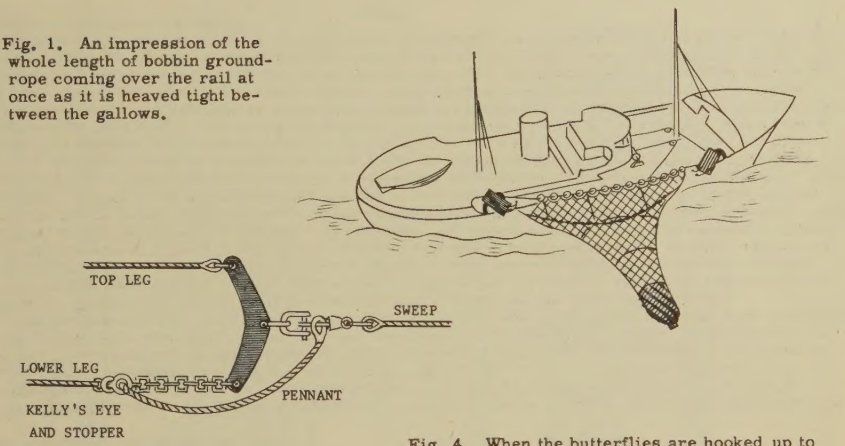

Fig. 4. When the butterflies are hooked up to the gallows, the sweep wire is connected to a pennant or independent wire allowing the winch to heave on the lower legs so bringing the bobbins tight between the gallows.

1.81

Seasonal variation in composition

	Glycogen		Fat		Protein	
	H.S.	L.S.	H.S.	L.S.	H.S.	L.S.
	%	%	%	%	%	%
May	4.28	1.52	1.45	1.18	12.06	7.58
June	2.08	1.25	0.91	0.91	10.45	9.54
July	0.77	0.55	0.85	0.57	11.26	10.11
August	0.78	0.52	1.00	0.76	10.12	9.61
September	0.10	0.08	0.86	0.82	10.06	9.24
October	0.53	0.30	0.46	0.41	11.33	8.47
November	1.68	1.29	0.88	1.00	11.10	11.00

H.S. - High salinity area. L.S. - Low salinity area.

Average vitamin content

	Micrograms per gram				
	Thiamine	Niacin	Riboflavin	Pantothenic	Pyridoxine
Barataria Bay					
High salinity	1.3	19.1	1.2	3.1	--
Low salinity	1.3	29.8	1.3	2.8	1.5
Bay Gardene					
High salinity	1.1	34.8	1.2	2.6	1.1
Low salinity	1.2	39.2	1.1	2.2	2.0
Grand Pass					
High salinity	1.1	40.4	1.3	2.1	3.2
Low salinity	1.1	47.6	1.2	2.4	3.2
Bay Ronquille (H.S.)	2.1	23.8	3.0	4.6	--
Bay Pizzati (L.S.)	2.6	20.2	2.7	4.4	--

2.1121

this strop a rope about $1\frac{1}{2}$ inches in circumference also is attached, with up to 3 dozen leads attached to weight the bag. The hauling lines are passed through rings that are about 4 inches in diameter and are hung from the lead line on ropes of $1\frac{1}{2}$-inch circumference and 1-fathom length spaced 2 to 3 fathoms apart.

The average vessel using a net of this size is 55 feet in overall length, with a beam of 19 or 20 feet, an engine of 150 h.p., and a total carrying capacity of about 100 tons of fish. The superstructure of the boat is situated well aft, and it contains a wheel house, a skipper's cabin, and the galley. The average crew consists of 10 men.

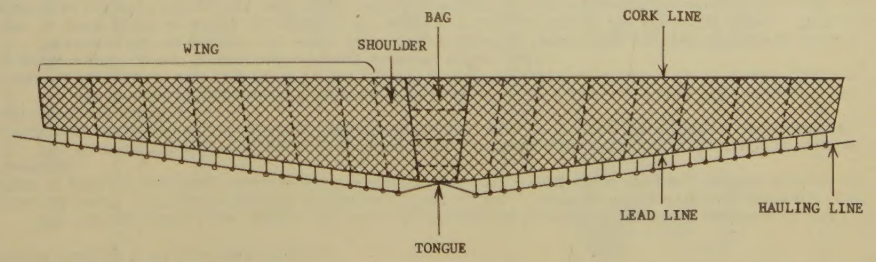

Fig. 1. Typical lampara net made of Marlon (not to scale).

2.118 AN ECONOMIC ANALYSIS OF FREEZING FISH AT SEA

Rosen, Sumner M. (Bureau of Business and Economic Research, Northeastern University, Boston, Massachusetts)
Commercial Fisheries Review 20, 1-14 (November 1958)

The New England fishing industry has experienced growing economic difficulties in recent years. In an attempt to find a solution to these difficulties, the U. S. Bureau of Commercial Fisheries tested and developed between 1948 and 1955 techniques and equipment for freezing whole groundfish at sea. The result of these experiments was a method that in the judgment of the Bureau, could readily be applied to the offshore fleet of large otter trawlers operating out of the Fish Pier in Boston, Massachusetts, and to the processing firms that process and freeze most of the catch of haddock, scrod, and other groundfish. Once the technical problems were solved, the question arose whether this new method would prove economically sound. This investigation was designed to answer that question.

The analysis included an examination of:

1. The effect of freezing at sea on domestic landings and prices, on the quality of the end product, on costs, and on earnings of the fishing fleet.

2. The size of investment that would be needed to convert the present fleet and present packaging plants to the new method, and the probable sources of such investment.

3. The effect that conversion might have on the ability of the domestic industry to compete with foreign sources of supply.

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2.1471 STERN TRAWLING FROM RUSSIAN PURSE SEINERS

Shentyakov, V. A.
World Fishing 7, 63, 64, 67 (August 1958)

The SO-300 class of seiners built in Russia in 1951 is designed and equipped for purse-seine, drifting, and stern trawling operations. The stern-trawling method used aboard these vessels is described. The basic 23-meter (71.2 ft.) Maklakov trawls were modified by lengthening the head line to 32 meters (99.2 ft.). The net is operated from a rotating platform on the stern (Fig. 1). The setting operation is similar to American stern trawlers; however, in the hauling operation the headline, groundrope, and body of the net remain in the water, hanging in a loose arc beneath the vessel. The bag is hauled to the working side with a pennant (lazy-line) and picked up with the boom tackle.

See illustration, over.

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 ABSTRACTER: Harold C. Johnson

3.2495 STUDIES ON PROTEIN DENATURATION IN FROZEN FISH. PARTS I, II, AND III.

Ironsides, J. I. M. and Love, R. M. (Torry Research Station, Aberdeen, Scotland)
Journal of the Science of Food and Agriculture 9, 597-617 (September 1958)

I. Biological factors influencing the amounts of soluble and insoluble protein present in the muscle of the North Sea cod. -- Ibid. 597-604. Considerable variation was observed in the percentage of total protein of the minced whole muscle of North Sea cod that was soluble in 5-percent sodium chloride. The authors found that by assaying certain myotomes that had been freed from myocommata rather than by assaying whole minced fillets, much of the variation in the results disappeared, especially that caused by differences in the lengths of the fish. Results of determinations that were spread over a period of 14 months, however, indicated that starvation and certain phases of the reproductive cycle can bring about changes in the amount of soluble protein in the myotomes of fish of different size, possibly as a result of a drain on the tissue resources of the fish.

These observations eliminated the necessity of considering several causes of variation in the amount of soluble proteins obtained under standard conditions, and also eliminated the collection of material with less than 1-percent variation. This material will provide the basis for research on freezing and cold-storage of fish.

II. Preliminary freezing experiments. -- Ibid. 604-609. Measurements have been made of the percentage of total myotome protein of frozen cod fillets that is soluble in 5-percent sodium chloride. The authors found that the soluble protein content decreased at a steady rate when the fillets were stored at -14° C. This is in contrast to the findings of some other workers. When the limiting value had been reached, after about 15 weeks in storage, no further decrease was observed even in

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 ABSTRACTER: Martin Heerdt

3.4 FISH IN FILM

Anonymous
Modern Packaging 32, 79, 160, 162 (January 1959)

A company in Los Angeles that markets cured and smoked fish has increased its sales volume by packaging its products in attractively designed, convenient, transparent film bags. In just 6 months, sales of packaged cod, for instance, exceeded the entire previous year's volume for the same item sold in bulk. Another product that formerly sold at a price loss is now a profit maker.

The reasons why the company decided to package its fish products are that many potential sales presumably were being lost because customers were reluctant to ask clerks for products they did not recognize and that there was an obvious need for brand identity to stimulate repeat sales.

Several problems were involved in converting a bulk operation to retail packaging: (1) Product shelf life had to be determined in regard to (a) moisture content, (b) storage characteristics of the specific species of fish, and (c) general appearance of the product as aging takes place. (2) Package size and design also had to be considered, and because individual fish of the same species vary in weight, an important design requirement was to provide a convenient method for store clerks to mark price and weight on the individual packages. Each of these factors had to be considered in relation to cost.

Transparent films were the final choice for the packaging medium. Polyester film, polyethylene, and combinations of polyethylene and cellophane printed with attractive designs that complement the color of the fish are the materials from which most of the bags used to market the fish are now made. Whole smoked fish are packaged in long narrow bags with transparent areas in the center

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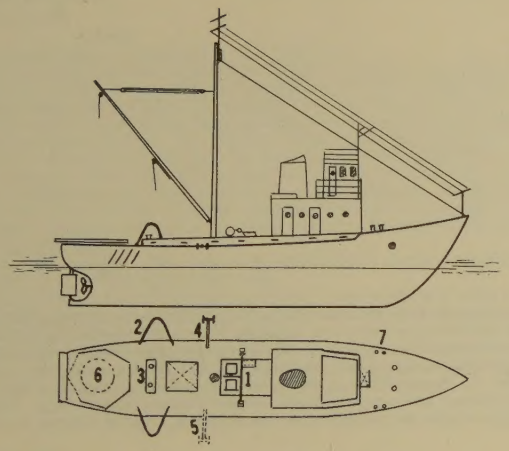
 ABSTRACTER: Kathryn L. Osterhaug

2.1471

General Arrangement of the SO-300 Type Seiner

1. Trawl winch
2. Gallows
3. Center roller bollards
4. Small pursing derrick
5. Alternative position for 4
6. Rotating platform
7. Mooring bollards



2.118 (Cross Reference: 9.2)

4. The attitude of key segments of the industry to the new method.

The conclusions of the study briefly were:

1. Adoption of freezing at sea would serve to smooth out the seasonal variation of catches and prices. It would thus make possible more efficient utilization of trawlers and packaging equipment, at lower cost and at higher rates of return than prevail under present conditions.

2. The investment needed to convert large trawlers presently operating out of Boston, on the basis of 1956 estimates, would be a minimum of $60,000 and a maximum of $87,500 if compression-type refrigerating equipment were used; a minimum of $58,750 and a maximum of $62,500 if ammonia-absorption equipment were adopted. On the other hand, the average age of the present fleet makes unlikely any investment of this size because they represent a range of 29.4 percent to 49.1 percent of the depreciated value of trawlers now in use.

3. Incorporation of freezing-at-sea equipment in new trawlers, if such are added to the fishing fleet in the future, would not materially increase the cost of such trawlers. In this case, the total costs are so great that such new investment is unlikely without some assistance from the Federal Government.

4. Imports have grown steadily through 1956--an indication that the share of the market for domestic production will, under present conditions, continue to decrease. Although precise comparisons of the costs of fishing and filleting abroad with those that could prevail in the domestic industry using freezing at sea are not possible, it is clear that the substantial savings in costs that the new method could make possible would improve the competitive ability of the domestic industry.

5. Facing a discouraging record of poor profits, unstable earnings for labor, and high costs of new capital equipment, few segments of the industry foresee adoption of the freezing-at-sea method in the foreseeable future, without substantial outside assistance. Fewer still were found who themselves would seriously consider adopting this new method.

3.4

that conform roughly to the shape of the fish. Solid-color printed borders contain brand identification and the name of the fish. A white printed square is provided for retail marking of price and weight.

Pickled fish, such as fillets of salt mackerel and imported Norwegian herring, require that an exact amount of brine be placed in each bag before sealing. This problem was solved by adapting a medical-syringe filling machine to draw measured amounts of brine from a drum and dispense it into the open end of the bag after the fish are inserted.

Barbecued Alaska cod and smoked cod fillet are packaged in square laminated polyethylene-polyester bags that can be placed in boiling water to heat before serving.

Mild-cured smoked salmon is marketed in clear, saran-coated cellophane pouches within a waxed-paperboard carton that has a die-cut window.

Each bag and shipping case is embossed with a date code to make it possible to check retailers' stocks to be sure the products are fresh.

3.2495 (Cross Reference: 3.239)

fillets stored for over 4 years at -14° C. Freezing increased the variation in the soluble proteins of individual fish in a given batch. Different rates of freezing have no relative effect on the soluble protein if the fish are thawed immediately after freezing.

III. The mechanism and site of denaturation at low temperatures.--Ibid. 609-617. The proportion of protein soluble in 5-percent sodium chloride was measured in cod muscle that had been frozen at intervals ranging from 10 to 490 minutes and stored for intervals ranging from 14 to 782 days at temperatures ranging from -14° to -29° C. Fish that were frozen in about 60 minutes contained more insoluble protein after storage for a given time than fish frozen within other intervals of time; this effect was very pronounced at low temperatures of storage. As a result of this study, the authors concluded that the solubility of fish muscle in salt solution changes during cold storage, owing to inorganic salt present in liquid solution in the frozen fish. Possible mechanisms of protein denaturation under various conditions of freezing are suggested.

Limitations in the decrease in soluble protein are presented for use as an index of deterioration in frozen and in cold-stored fish.

3.61 RAPID VACUUM FREEZE-DRYING OF MEAT

Brynko, C. and Smithies, W. R. (Defense Research Medical Laboratories, Toronto 12, Ontario, Canada)
Journal of the Science of Food and Agriculture 9, 576-583 (September 1958)

Introduction.--A need exists for dehydrated raw-meat items in the form of chunks, steaks, chops, and roasts in serving-size pieces, that will rehydrate in a few minutes and, when cooked, will closely resemble fresh or frozen cooked meat in flavor and texture. These properties should be retained during storage without refrigeration.

Drying under vacuum has been shown to be a suitable means of dehydrating pieces of raw meat. The quality of the product depends largely on the degree of vacuum employed. At pressures of 3 to 30 millimeters (mm.) of mercury the product shrinks, becomes dark in color, and rehydrates slowly. At pressures below 3 mm. and preferably below 1.5 mm. of mercury, the meat is frozen during drying and no shrinkage occurs. The typical freeze-dried product is pale in color and very porous. It rehydrates in a few minutes, and after it has been cooked it is difficult to distinguish from cooked fresh meat. The present study was confined to the heated plate- or shelf-type of freeze-drying equipment and to its adaptation to a process of rapid freeze-drying.

Materials.--Canada Grade-B, beef sirloin, round, rib and loin, and pork loins were purchased locally, boned, roughly dissected into muscles or cut into roast-size pieces, frozen, and stored at -16° C. Steaks and chops were cut in the frozen state.

Equipment.--The basic equipment consisted of a Stokes Industrial Model No. 2005FX-4 freeze-drier evacuated by a 1.5-h.p. Stokes 'Microvac' pump that had a capacity of 32 cu. ft. per min. and was fitted with an oil clarifier. The vacuum chamber contained four hollow drying shelves 2 feet by 3 feet in size and located above two refrigerated plates of similar size. The drying shelves either could be cooled or heated in the temperature range -30° to 100° by means of a methyl cellosolve circulating system. Water vapor that sublimed from the frozen samples during the drying cycle was

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 ABSTRACTER: Martin Heerdt

4.21 RATES STUDIES OF AND PRODUCTS OF UNSATURATED FATTY ACID OXIDATION CATALYZED BY HEMATIN COMPOUNDS

Maier, Vincent P. and Tappel, A. L. (University of California, Davis)
Journal of the American Oil Chemists' Society 36, 8-15 (January 1959)

Introduction.--Hematin catalyzed unsaturated fatty acid oxidation is a basic mechanism (1) of in vivo pathological reactions that occur in vitamin E-deficient animals and (2) of fat oxidation that causes the rancidity of meat, poultry, and fish. In contrast to these deleterious reactions, hematin catalyzed peroxide decomposition might be used beneficially in processes requiring the initiation of free-radical propagated polymerization reactions.

Purpose.--In order to study this reaction, a spectrophotometric method was developed, based on the decrease in diene conjugation of linoleate hydroperoxide as catalytically decomposed by hemoglobin. With this technique, a study was made to learn of the effects of linoleate hydroperoxide concentration, hemoglobin concentration, and temperature on the rate of the reaction. In addition, the authors determined the catalytic activities of several hemoproteins, metallo-protoporphyrine, and other interesting metal-chelate compounds.

Rate studies of unsaturated fatty acid oxidation.--Hemoglobin and hematin were found to catalyze the oxidation of homogeneous as well as heterogeneous linoleate systems. The interrelationship of several factors affecting the rate of this reaction was studied. In addition, a spectrophotometric method was developed for studying the rate of decomposition of linoleate hydroperoxide by hematin compounds. This method was used to study the effects of linoleate hydroperoxide, hemoglobin concentration, and temperature on the rate of hydroperoxide decomposition.

Both an alpha-cumyl hydroperoxide and a methyl linoleate hydroperoxide were used in the

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4.21 FISH MEAL AND OIL 4. THE RATE OF OXIDATION OF FAT IN PILCHARD PRESSCAKE

Dreosti, G. M. and Stander, G. H.
Annual Report, Fishing Industry Research Institute, Cape Town, South Africa, 10, 18-20 (April-December 1956)

Purpose.--The rate of oxidation of fat in pilchard press-cake was studied to learn the effect of delay between the collection of press-cake samples and their analysis.

Experiment 1.--A sample of press cake made from pilchards that had been out of water for 8 hours was subjected to 20 minutes of direct cooking at 4 to 5 pounds per square inch of steam pressure and was pressed in a wheel press, ground, and divided into two lots. Lot 1 was held in a closed desiccator in a $\frac{1}{4}$-inch-thick layer on a sheet of glass, whereas lot 2 was exposed to the open air in a $\frac{1}{4}$-inch-thick layer on a sheet of glass. The desiccator was opened at regular intervals to assure an adequate supply of oxygen to the samples in lot 1.

Results with experiment 1.--During the initial 24 hours of storage in the desiccator, the hexane extract of the press cake in lot 1 decreased by 20.6 percent, whereas the acetone extract of the press cake decreased by 15.0 percent. After 93 hours of storage, the hexane extract had decreased by 36.0 percent of its original value, whereas the acetone extract had decreased by 22.1 percent of its original value. These values appear to have been influenced by the fact that the material in the desiccator showed signs of spoilage after 66 hours.

Press cake from lot 2, which had been exposed to the open air, dried rapidly--in 66 hours--from an initial moisture content of 51 percent to a moisture content of 11 percent. Spoilage did not

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 ABSTRACTER: Martin Heerdt

4.4 LIPID CHANGES IN ICED COD. 1. PHOSPHOLIPIDS. 2. NON-PHOSPHORYLATED LIPIDS

Lovern, J. A.; Olley, June; and Watson, Helen A. (Torry Research Station, Aberdeen, Scotland)
The Biochemical Journal 70, 2p-3p (September 1958)

Experimental.--Cod flesh contains 0.5 to 0.6 percent total lipid, of which 50 to 65 percent is phospholipid (Garcia, Lovern, and Olley 1956). Gutted cod were stored in ice for up to 56 days, samples were withdrawn periodically, and the flesh lipids were extracted and fractionated chromatographically on silicic acid. The fractions were identified analytically and by elution characteristics.

Results with phospholipids.--Very little lipolytic activity of any kind could be detected during the first 14 days of storage in ice, and a decrease in the ester groups of the nonphosphorylated lipids did not occur. Total phospholipids, however, decreased about 10 percent. Free fatty acid production approximately matched phospholipid breakdown. Cod stored from 14 to 28 days in ice, when bacterial multiplication is maximal, showed 32-and 40-percent breakdown of phospholipids, respectively, in two experiments. Maximum phospholipid breakdown did not occur until after 35 days of storage. This amounted to a breakdown of 72 and 76 percent of the original phospholipids in two series of experiments.

Throughout this period there was no accumulation of lysophosphatides, phosphatidic acids, or diglycerides. The final phospholipid mixture closely resembled the initial one in that it contained about 40 percent lecithin, 20 percent phosphatidylethanolamine, 22 percent unidentified nitrogenous phospholipids, 15 percent phospholipids not based on simple glycerophosphate, and traces of phosphatidylserine and phosphoinositides. Production of free fatty acid was equivalent to the amount of phospholipid breakdown during one entire storage experiment of 49 days' duration and during 35 days of storage in another experiment. After these periods of phospholipid breakdown, partial destruction

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 ABSTRACTER: Martin Heerdt

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occur. During the initial 24 hours of storage in the open air, a hexane extract of the press cake decreased by 20.6 percent of its original value, whereas an acetone extract of the press cake decreased by 16.1 percent of its original value. After 93 hours of storage, the hexane extract had decreased by 30.3 percent of its original value, whereas the acetone extract had decreased by 18.9 percent of its original value.

Experiments 2 and 3.--Experiments 2 and 3 were replicates of experiment 1, but periods of storage were shortened to obtain a more complete picture of the rate of oxidation of the press cake. The press cake was spread in $\frac{1}{4}$-inch layers on glass plates, exposed to the open air only, and analyzed at intervals of up to 24 hours. In experiment 2, the original press cake contained 51.2 percent moisture; whereas in experiment 3, the original press cake contained 48.8 percent moisture.

Results with experiments 2 and 3.--After the press cake was exposed to air for $\frac{1}{2}$, 3, 6, and 24 hours in experiment 2, the hexane extract of press cake decreased to 9.26, 8.36, 8.10, and 7.30 percent, respectively; whereas the acetone extract decreased to 10.76, 9.64, 9.48, and 8.80 percent, respectively. After the press cake was exposed to air for $\frac{1}{3}$, $2\frac{1}{2}$, and 6 hours in experiment 3, the hexane extract of the press cake decreased to 9.09, 7.37, and 7.04 percent, respectively; whereas the acetone extract of the press cake decreased to 10.03, 8.48, and 8.35 percent, respectively.

Losses during the first 20 minutes can amount to 0.2 to 0.5 percent of these extracts. Reasons for the more rapid losses in experiment 3, as compared with those in experiment 2, are not known. It is probable, however, that the rate of oxidation of different lots of pilchards varies widely.

Conclusions.--These studies indicate that on exposure to the open air, the fat in fresh press cake is subject to rapid oxidation even at room temperature. Both the hexane- and acetone-extractable fats decrease rapidly. A delay of even 1 hour before analysis may lead to an error of more than 1 percent in the value of the extractable fat.

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of free fatty acids occurred. Further changes did not occur in the period of from 41 to 56 days of storage.

Conclusions with phospholipids.--Under these conditions, enzymic degradation appears to occur at the same rate in all the various phospholipids present and to affect both of the fatty-acid ester linkages. Dawson (1958) points out that phosphoinositides and polyglycerol phosphatides, both of which occur in cod-flesh lipids, catalyze the removal of both fatty acids with phospholipase B.

Results with nonphosphorylated lipids.--During prolonged storage of gutted cod in ice, marked changes were observed in the free and esterified cholesterol and free fatty acids of the flesh, but not in other nonphosphorylated lipids (Garcia, Lovern, and Olley 1956). Free fatty acids are produced by bacterial breakdown of phospholipids with a pronounced effect on their mean iodine value. This value increased from an initial 156 to a maximum of 290 after 28 days and subsequently declined to 215. Cardin and Bordeleau (1957) did not explain why the production of free fatty acids in salted cod involved an increase in the mean iodine value of the phospholipids from an initial value of 139 to a final value of 211.

Free sterol decreased throughout the storage period and reached about one-twelfth of its initial value after 56 days. Esterified sterol increased steadily with one marked interruption. The extract prepared from a single sample of three fish after 28 days of storage in ice contained virtually no esterified sterol. In place of the esterified sterol, the authors found an unidentified nonester substance. The general increase in esterified sterol is not due to simple esterification of free cholesterol. Total sterols decreased by about 47 percent during the first 14 days of storage, then slowly increased again--except for the 28-day sample--and finally reached values that were only 10 to 15 percent below the initial value. Free cholesterol was lost initially in the 28-day sample to an intermediate product that appeared to be eluted with the sterol ester-hydrocarbon fraction. The sum of this intermediate product and the free cholesterol fraction, however, remained approximately constant.

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condensed on the refrigerated plates, which were maintained at -35° to -40°. This equipment has a condensation capacity of 10 litres of water corresponding to a capacity for drying about 25 to 30 pounds of raw meat. The actual batch sizes used during this investigation varied from $\frac{1}{2}$ to 13 pounds of meat. The progress of drying was followed by means of plastic-coated copper-constantan thermocouples embedded in the samples and in contact with the heater plates.

Conventional freeze-drying.--Frozen beef round and sirloin steaks about $\frac{1}{2}$-inch thick were laid directly on shelves that were heated to 20° C., when the vacuum was first applied, and were raised in temperature gradually to 40° to 45° C. as drying proceeded. Dehydration occurred first at the outer surface; the central undried portion remained in the frozen state. As the drying proceeded the ice-phase boundary moved inward until the ice had disappeared. Completion of drying ranged from 15 to 20 hours. Regression of the ice-phase boundary was faster on the side in contact with the hot shelf than on the top surface. Meat slices laid on trays or in poor contact with the shelf surface dried more slowly than those in good contact.

Vacuum contact-plate drying.--Conventional equipment was adapted to provide vacuum, contact-plate freeze-drying. This was accomplished by placing an electrically heated aluminum plate on top of meat steaks that were lying on the drying shelf. The shelf and plate temperature then was raised from 20° C. at the start of drying to 40° to 50° C. during drying. This change reduced the drying time for $\frac{1}{2}$-inch-thick meat slices from 15 to 20 hours to 7 to 10 hours.

Rapid freeze-drying using spiked plate units.--When the meat was laid between two aluminum, spiked heater plates, both of which were heated electrically and so arranged that 3/32-inch spikes penetrated from top and bottom at uniform intervals of 3/8 inch, drying times could be reduced to as little as $2\frac{1}{2}$ hours. Electrical heaters permitted controlled and uniform heating and more rapid rises in plate temperature than was possible with the original heating system.

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identification of the initial products of the hematin-hydroperoxide interaction. Alpha-cumyl hydroperoxide was chosen because of its well-studied reactions with ferrous ion and methyl linoleate hydroperoxide present in oxidizing fats. Since alkoxy free-radicals were the expected initial products, hydroquinone was used as a radical trap in the reaction system to convert the alkoxy radicals into their corresponding alcohols.

Products of unsaturated fatty acid oxidation.--The initial and secondary products resulting from the hematin catalyzed decomposition of hydroperoxides are described in the second part of this paper. The initial product was found to be an alkoxy free-radical produced by the homolytic cleavage of the O-OH bond of the hydroperoxide. The system was arranged so that as the alkoxy radicals were formed they were able to react with a hydrogen donor. This reaction produced the corresponding alcohol, which then was identified by standard physical and chemical procedures.

Secondary products resulting from the hematin catalyzed decomposition of linoleate hydroperoxide in the absence of oxygen were found to be composed principally of oxirane, hydroxyl, and carbonyl compounds. Cleavage of the carbon chain, loss of conjugated double bonds, and polymerization also took place. Reactions to account for these products were proposed along with a general mechanism of hematin catalysis.

4.60 THE ROLE OF FREE FATTY ACIDS ON ANTIOXIDANT EFFECTIVENESS IN UNSATURATED OILS

Olcott, Harold S. (Department of Food Technology, Institute of Marine Resources, University of California, Berkeley)
Journal of the American Oil Chemists' Society 35, 597-599 (November 1958)

Introduction. --Studies of the comparative effectiveness of various antioxidants in marine oils revealed that 6-ethoxy-2, 2, 4-trimethyl-1, 2-dihydroquinoline (EMQ) was considerably more effective than were nordihydroguairetic acid (NDGA) or propyl gallate (PG) in samples of crude menhaden, herring, anchovy, and other fish oils. EMQ and NDGA were equally effective in refined cod-liver oil; NDGA was more effective as an antioxidant in lard than was EMQ. An investigation of the various possible factors causing these differences revealed that the amount of free fatty acid in the oils is important.

Purpose. -- Further studies undertaken to determine the effect of free fatty acid on the stability of substrates and on the effectiveness of antioxidants are described in this paper. Materials used included samples of crude fish oils; highly purified fractions of sardine oil methyl esters and alcohols; refined cod-liver oil; purified fatty esters, acids, and glycerides; an unsaturated fraction from menhaden oil; a commercial sample of lard free from antioxidants; refined vegetable oils; and myristic and palmitic acids recrystallized from alcohol.

Experimental. -- The effectiveness of the antioxidants was estimated from the length of the induction period as determined by the weighing method of Olcott and Einsett (1954). Samples consisting of 200 milligrams or 1 gram of oil with or without antioxidant were incubated in beakers in constant-temperature draft ovens, removed once daily, allowed to cool, weighed, and returned to the ovens.

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 ABSTRACTER: Martin Heerdt

6.134 FISH TAG RECOVERY

Stander, G. H.
Annual Report, Fishing Industry Research Institute, April-December 1956, Cape Town, South Africa, 10, 20-21 (1957)

Tests were made at Walvis Bay to improve the efficiency of existing magnetic installations for recovering fish tags. The investigation included plants with airlift driers and plants having direct and indirect cookers, wheel and screw presses, and steam-tube and hot-air driers in various combinations.

Magnetic efficiency was tested by dropping 20 or 25 tags, at 30-second intervals, into the screw conveyor just before the dry mill. Overall efficiency was determined by dropping 20 or 25 tagged fish into the fish conveyor in front of the fish pit. In each case, the magnet was examined hourly for at least 25 hours. The fish used gave a good cross section in terms of size and were generally firm.

Plant A - permanent magnet at the dry-mill intake. --Recovery of 76 percent to 85 percent of the tags represented an average overall recovery of 79 percent, which was regarded as satisfactory.

Plant B - permanent magnet fitted near the dry-mill intake. -- Magnet efficiencies of 10 percent to 25 percent were obtained. This low recovery was thought to be due to an air-intake aperture located a few inches from the magnet, which tended to deflect the meal away from the magnet surface. In tests with the aperture temporarily covered, 90 percent of the tags were recovered.

The original aperture now was welded up, and a similar opening was made at the other side of the duct. A magnet efficiency of 88 percent to 100 percent was eventually obtained by varying the size and the position of the opening.

The overall efficiency of the installation was tested next, with an average of 81 percent of the tags being recovered.

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 ABSTRACTER: June H. Olden

5.120 ACTION OF VITAMIN A

Anonymous
Nutrition Reviews 17, 22-24 (January 1959)

Although the mechanism of action of Vitamin A in scotopic (dim light) vision is now fairly well known, there has been little indication that this action might be connected to this vitamin's more general function of maintenance of the epithelial tissues. As a matter of fact, the general function of vitamin A in preventing atrophy of the epithelial tissues, and consequent susceptibility to bacterial invasion, is poorly understood.

One suggestion has appeared in a study by J. F. Dowling and G. Wald (1958), which was aimed at outlining the total relationships of night blindness to vitamin A deficiency.

Although the relationship of vitamin A to retinene, rhodopsin, and the action of the rods is an obvious and direct one, certain discrepancies have existed. For instance, the time taken to develop night blindness on a vitamin A deficient diet varies greatly with the individual, and the time to cure the deficiency symptom with vitamin A therapy may vary from days to many months. In the first case, the authors considered evidence that the vitamin A stores of the liver, which vary greatly in individuals and with previous dietary habits, might prevent the visual symptoms until the stores were exhausted. In the second case, it seemed plausible that a prolonged deficiency might result in a deterioration of the rods themselves, repair of which would take more time than would a simple recombination of retinene with opsin.

In order to study these hypotheses, the authors followed the course of development and cure of vitamin A deficiency in male weanling rats. Measurements were made of the concentration of vitamin A in liver and blood, of rhodopsin in the retina, and of the electroretinographic thresholds and electroretinographs (ERG) over a wide range of light intensities. Opsin was measured by the capacity of the retinas to regenerate rhodopsin when incubated with neo-b (11-cis) retinene. In some

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6.190 A COMPARISON OF THE NUTRITIVE VALUE OF CONDENSED HERRING SOLUBLES PREPARED BY ACID AND ENZYME TREATMENTS

March, B. E.; Biely, Jacob; McBride, J.; MacLeod, R. A.; and Idler, D. R. (University of British Columbia, Vancouver, B. C., Canada)
Fisheries Research Board of Canada, Progress Reports of the Pacific Coast Stations, No. 111, 23-28 (August 1958)

The purpose of this study was to determine and compare the relative nutritive value of herring solubles prepared in the laboratory (a) by acid digestion and (b) by enzymic digestion.

Solubles prepared by acid digestion. --Fresh herring, presumably minced, were cooked in 50 percent by weight of water for 20 minutes with live steam, acidified with sulfuric acid to a pH of 4.5, held at 170° F. for 30 minutes, and centrifuged to remove coagulated protein. The remaining supernatant liquid was heated to 200° F., passed through a disc-bowl centrifuge to remove oil, and concentrated to solubles by flash evaporation.

Solubles prepared by enzyme digestion. --Fresh herring, presumably minced, were processed according to the acid-digestion method outlined above except that Rhozyme B-6 was added to the batch of cooked herring at the rate of 0.5 percent of the total solids present in the batch in place of sulfuric acid. Digestion was allowed to proceed at a natural pH of 6 to 6.5 for 2 hours at 140° F. The solubles obtained were adjusted to pH 4.5.

Nutrition studies. -- Solubles from acid-digested herring, solubles from enzyme-digested herring, herring press cake, and an acidulated commercial sample of herring solubles were compared in Test 1 at levels of 2, 4, and 6 percent as supplements to a corn-soybean basal diet that contained

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 ABSTRACTER: Martin Heerdt

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cases, retinal histological examinations were also performed.

At the start of the deficient diet, the content of vitamin A in the liver of the rats began to decrease, reaching very low levels at 3 weeks. Since the rate of decrease was about 2 micrograms per day, as compared with a usual increase of about 45 micrograms per day on a normal diet, it is evident that very young rats had to be used for the experiment. By way of comparison, depletion of the stores of a well-nourished adult human being might take 2 to 10 years. No further symptoms were apparent until the liver supplies were exhausted, when blood levels of vitamin A fell precipitously to zero. At this point, the rhodopsin content of the retinas began to fall, reaching a low level in about 3 weeks. The outward symptom of this decrease was a rise in the ERG threshold, an indication of the onset of night blindness. At 4 weeks, before the drop of vitamin A in the blood, the threshold was unchanged. At 5 weeks it had increased 14-fold, and at 8 weeks, when the animals were succumbing to the deficiency and the rhodopsin content of the retinas was only 16 percent of normal, the threshold had increased 680-fold. It was found that from $4\frac{1}{2}$ weeks, the log of the ERG threshold, in arbitrary units, rose almost linearly with time on the deficient diet and with the decline of retinal rhodopsin.

The retinal opsin content remained normal through the 6th week, when the retinal rhodopsin was 50 percent of normal. Thereafter, it began to decline, until at 8 weeks it had dropped about 50 percent, and marked deterioration of retinal tissue, especially the outer segments of the rods, appeared. At this point, the animals were deteriorating generally, and it was concluded that the opsin was probably only one example of a general destruction of proteins in epithelial structures.

The reversal of these symptoms, with intraperitoneal injection of vitamin A (oral administration gave irregular results), followed the reverse order of their initiation. The ERG thresholds returned to normal in 50 to 60 hours, the time for recovery depending on the extent of damage to the retinal opsin. When the 11-cis isomer was injected, a lag in recovery was apparent, indicating that although this is the isomer actually used in the retina, only the all-trans is effective in reaching this site. It was evident that the return to normal ERG-threshold values presupposed the isomerization of all trans to the 11-cis isomer (presumably in the eye tissues themselves), the repair or replacement of the degenerated rods and opsin, and the combination of opsin and retinene to form rhodopsin. The general recovery of the animals from this stage of deficiency required considerably more time.

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The oleate, lard, and vegetable oils were held at 60° F.; the fish oils and trilinolein were held at 50° C.; and the esters were held at 40° C.

The end of the induction period was estimated to the nearest half-day, as judged from the increase of weight by 0.5 percent. All of the highly unsaturated substrates had induction periods of only a few hours at the temperatures employed; hence the data cannot be used to compare the relative stabilities of the unprotected oils or esters. Even though all of the substrates were held under nitrogen and at 0° F., their stabilities changed during storage. Accordingly, the comparisons within a single run are of more significance than are those between runs.

Results.--Relative antioxidant activity was affected by the number and type of double bonds in the substrates. NDGA was superior to EMQ in purified methyl esters of oleic, linoleic, linolenic, and arachidonic acids that contain 1, 2, 3, and 4 unsaturated bonds, respectively. NDGA also was superior to EMQ in trilinolein and in very highly unsaturated fractions of esters of menhaden and sardine oils, which have iodine values of 350 to 360. In contrast, free fatty acids corresponding to the esters used above and free fatty acids prepared from menhaden, cod-liver, and cottonseed oils were protected much more effectively by EMQ than by NDGA.

In experiments carried out with mixtures of purified esters and acids, added free fatty acid was effective at very low concentrations and adversely affected the antioxidant effect of NDGA relatively more than it did that of EMQ. This observation suggested that if the free fatty acids were removed, the resultant neutral oil would be protected better by NDGA than by EMQ. Data were obtained to support this hypothesis. A comparison of various fatty acids at hand indicated that the effect of free fatty acid could be demonstrated with several saturated fatty acids and with monobasic and dibasic fatty acids. Citric and phosphoric acids were exceptions, as was to be expected from their known activity as synergists.

The addition of oleic acid to trilinolein decreases the antioxidant activity of all of the antioxidants used, but to varying degrees. Amounts as low as 0.1 percent of oleic acid modified the antioxidant action of α- and γ-tocopherols. Inasmuch as the tocopherols are considered to be the natural antioxidants in vegetable oils, these observations suggested that oleic acid and other fatty acids would reduce the induction period of such oils. The induction period of lard, in contrast, was not measurably affected.

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no fish meal or dehydrated green feed but was supplemented with vitamins and with methionine. Soybean-oil meal in the basal diet was reduced to accommodate the added solubles without raising the protein level of the diet. Each diet was fed to duplicate lots of 15 female New Hampshire chicks. In no instance was there a response to the addition of the condensed solubles or of the press cake.

In Test 2, the chicks received a corn-soya type of basal diet without vitamin B_{12} but supplemented at levels of 0.5, 1.0, and 2.0 percent with different laboratory-prepared herring solubles. Chicks that received the solubles in their diets grew more rapidly than did those that received the basal diet only. No difference was apparent in the response of the chicks to solubles from acid- and enzyme-digested herring at the levels fed. Pure vitamin B_{12} added to the basal diet produced no additional response.

Test 3 was conducted to compare (a) the effect of herring solubles from acid- and enzyme-digested herring added at 1- and 2-percent levels of the diet, (b) the effect of folic acid added at the rate of 0.25 mg. per lb. of diet, and (c) the effect of methionine added at a 0.1-percent level of the diet. These supplements were added to a basal diet similar in composition to the basal diet employed in test 2. Duplicate lots of 20 male chicks received each diet. When their diet was not fortified with folic acid, they responded to herring solubles, which contained this vitamin. Chicks fed diets containing herring solubles did not respond to added folic acid or methionine.

Test 4 was designed to compare solubles from acid-digested herring with solubles from enzyme-digested herring specifically on the basis of their value as protein supplements to a basal diet that contained ground yellow corn, ground wheat, soybean-oil meal, and cerelose. Supplementation was accomplished by substituting 5-pound and 10-pound levels of the solubles for 2.5-pound and 5.0-pound levels of cerelose. A mixture of 1.72 pounds of isolated soybean protein, 0.50 pounds of dl-methionine, and 0.25 pounds of glycine was added per 100 pounds of basal diet to serve as a reference standard for the 10-pound level of solubles. Each diet was fed to 25 male chicks for 3 weeks. Differences were not apparent in the nutritive value of the different types of solubles for the growth of male chicks over a 3-week period. In comparative nitrogen-balance studies, only the diet supplemented with a 10-pound level of solubles resulted in a slightly lower nitrogen retention in chicks that received the purified protein supplement and a markedly lower nitrogen retention in chicks that received either sample of solubles.

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Plant C - permanent magnets at each dry-mill intake.--Magnet efficiencies between 45 percent and 65 percent were obtained. As in the previous case, apertures were cut into the ducts on which the magnets were mounted to get the meal into closer contact with the magnet surfaces. The units then gave recoveries between 84 percent and 96 percent.

The overall efficiency now was tested, and tag recoveries averaged between 75 percent and 86 percent.

Plant D.--Magnet efficiencies were only 50 percent to 65 percent, and adjustments to air and meal flow did not result in improvement. A more powerful magnet is being fitted.

Plant E - special permanent magnet between airlift driers and dry mill.-- Magnet efficiency of 90 percent was obtained. Tests were run to establish whether tags were sufficiently light to be picked up and carried over by the airlift drier. In the first test, 80 percent of the tags were collected from the droppings, and 5 percent from the magnet. In a repeat test, 68 percent of the tags were recovered from the droppings, and 25 percent from the magnet.

In a test for overall efficiency, tag recovery of 90 percent was obtained, two-thirds from the droppings and one-third from the installed magnet. Tests were performed to prove that if the drier droppings were continually fed back into the drier, all tags contained in the droppings would sooner or later be carried over by the drier and caught by the installed magnet. An average overall tag recovery of 76 percent was obtained.

Plant F - airlift drier.-- With magnets mounted between the cyclone and the dry mill and an aperture cut into the duct to deflect the meal toward the magnet, magnet efficiencies as low as 25 percent were recorded. An attempt therefore was made to collect the tags after the dry mill.

A magnet mounted at the discharge end of the conveyor feeding milled meal into a hopper above the bagging machine was capable of collecting 100 percent of the tags passing over it. In tests with tags introduced into the plant just prior to the dry mill, 92 to 96 percent of the tags were recovered.

The overall efficiency of the installation now was tested, with an average of 76 percent of the tags being recovered.

2.41 CONTAINERS FOR TRANSPORTING FRESH FISH IN ICE

Nachenius, R. J.
Annual Report, Fishing Industry Research Institute, 1957, Cape Town, South Africa, 11, 14 (1958)

Small quantities of fresh fish, of the order of 30 to 100 pounds, have been sent frequently, in unrefrigerated spaces, on journeys which may take up to 24 hours. The fish is packed in crushed ice in wooden boxes. As the weight of ice that can be packed with the fish in small boxes is limited, attention was devoted to the problem of ensuring a sufficient amount of ice until the end of the journey without materially increasing the cost of packaging.

One solution would be to insulate the boxes. However, the insulation would materially increase the overall size of the containers, and the question arose as to whether it would be more beneficial to employ a box of the same overall dimensions as would be reached if the small box in current use was to be insulated, and to fill the space intended for insulation with additional ice.

The theoretical analysis of this question is as follows:

Let V = Net internal volume in cu. ft. of a given size box.
S = Surface area of the box in sq. ft.
T = Thickness of insulation in inches, applied to the inside of the box.
K = K factor of the insulation material in BTU inches per sq. ft. per hr. per °F.
K_o = U factor of bore walls of box in BTU per sq. ft. per hr. per °F.
D = Density of crushed ice in pounds per cu. ft.
v = Temperature in °F. of atmosphere above ice point.
W = Weight of ice in pounds left in box (initially filled with ice) after the journey.
t = Period of journey in hours.

Then, for small thicknesses of insulation: $W \propto \left(V - \frac{ST}{12}\right)D - \frac{Svt}{\left(\frac{1}{K_o} + \frac{T}{K}\right)144}$

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7.80 FISH SPOILAGE I. DETERMINATION OF BACTERIAL METABOLITES BY GAS CHROMATOGRAPHY

Groninger, Herman S. (U. S. Bureau of Commercial Fisheries, Seattle 2, Washington)
Commercial Fisheries Review 20, 23-26 (November 1958)

Spoilage patterns.--The accumulation in fish of bacterial metabolites with unpleasant odor and flavor characteristics is called spoilage. Spoilage usually is studied through the identification and measurement of the metabolites formed. In addition to this information, there is need also for information concerning the sequence in which metabolites are formed under specific conditions of storage.

An important aid in these studies would be the development of better analytical methods for measuring bacterial metabolites. Gas chromatography, which is a relatively new analytical tool, promises to be useful in problems of this type. The objectives of the study reported in this paper were (1) to investigate the use of gas chromatographic techniques in the study of spoilage patterns and (2) to fractionate, by gas chromatography, the volatile nitrogen constituents of fish.

Study of spoilage patterns.--(1) Ground cod and halibut samples were spoiled under controlled conditions for various periods of time. (2) The spoiled fish was adjusted to a pH of 9.3 and distilled at a temperature of 30° C. at 30 millimeters pressure for 2 hours. In order to remove the volatiles, nitrogen gas was bubbled through the fish slurry and then passed through a series of traps that were maintained, respectively, at 0°, -77°, and -195° C. (3) The condensates from the 0° and -77° traps were found to contain only water. The condensate from the -195° C. trap was chromatographed at 100° C. immediately after it was collected. A column packing of Carbowax 1,000 and a flow rate of helium of 60 milliliters per minute were used.

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ABSTRACTER: Kathryn L. Osterhaug

6.195 THE USE OF AMINO ACID VALUES IN FORMULATION OF FEEDS

Wiigus, H. S. (The Roy Ewing Co., Pasadena, California)
Feedstuffs 30, 26 (December 20, 1958)

Nutritional requirements.--Adequate amino acid balance is necessary in the rations of non-ruminating animals of all ages. The nutritionist who formulates rations is faced with the following difficulties in attempting to provide optimum amino acid balance:

(1) In the formulation of practical rations for the later growing periods, information on the essential amino acid requirements of young chicks, of poults, of pigs, and of laying hens is lacking or fragmentary. (2) These requirements tend to increase with increasing levels of dietary protein. (3) An excess of one amino acid may depress growth or increase the requirement for another amino acid. (4) The source of carbohydrate may influence amino acid requirements. (5) An increase in the energy levels of the ration tend to increase the amino acid requirements proportionately. (6) Levels of other nutrients also may influence amino acid responses. For example, a slight deficiency of vitamin B_{12}, choline, or sulfate may cause diversion of some methionine from structural purposes to other metabolic functions. A lack of niacin similarly may cause diversion of tryptophane. (7) Breed differences with respect to amino acid requirements also appear to exist. (8) A lack of agreement exists in amino acid values that appear in tables of average ingredient analyses prepared by different authorities. (9) Variations in the amino acid composition of an ingredient inherently may occur and may be impaired by storage and processing. (10) Methods of assay used do not always reflect the biological availability of an amino acid.

Use of existing knowledge.--The practical nutritionist can make excellent use of existing knowledge by exercising judgment. To this end, the following suggestions are offered:

Rations formulated on the basis of amino acid adequacy rather than on arbitrary protein levels will promote better biological efficiency and help to avoid the influence of excesses and inadequacies.

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ABSTRACTER: Martin Heerdt

7.80 A REVIEW OF THE VALUE OF VOLATILE REDUCING SUBSTANCES FOR THE CHEMICAL ASSESSMENT OF THE FRESHNESS OF FISH AND FISH PRODUCTS

Farber, Lionel and Lerke, Peter A. (The George Williams Hooper Foundation, University of California, San Francisco)
Food Technology 12, 677-680 (December 1958)

This paper reviewed the value of volatile reducing substances for the chemical assessment of the freshness of fish and fish products and gave the volatile reducing substances (VRS) values for different fish and for a number of fishery products.

Materials and methods.--All samples tested were part of commercial batches of fish and fishery products. The procedure of Farber (1956) was used for the determination of VRS values.

Results.--The VRS values in raw fish closely followed the organoleptic judgments for fillets of Dover, lemon, petrale, English sole, California flounder, and a number of species of rockfish.

Good correlation between VRS values and sensory judgment was found for the steaks of Pacific halibut.

VRS values could be correlated with sensory judgment on dressed salmon much better than could volatile nitrogen values.

The VRS content of swordfish and white sea bass followed sensory judgment very closely.

Cured fish.--With both salted cod and salted herring, the VRS values showed a distinct

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ABSTRACTER: Herman S. Groninger

ICED FISH CONTAINERS

AMINO ACID VALUES OF FEEDS

CHROMATOGRAPHY OF METABOLITES

VRS AND FISH FRESHNESS

6.195

The energy content of the rations used in the determination of amino acid requirements should be given. This will permit the adjustment of the amino acid levels of a given ration to the energy content of the ration. Metabolizable energy appears to be the most practical expression of caloric value for the feed formulator.

Average values for amino acid composition of feed ingredients should be brought into agreement and revised at frequent and regular intervals. Greater use should be made of assays for the water-soluble nitrogen in cottonseed meal, for the protein digestibility of fish and meat products, and for the available lysine. These assays can aid processors in improving their products and aid control laboratories in ascertaining sources of properly processed ingredients. Consideration should be given to other major nutrient contributions when comparing the relative cost of different ingredients as sources of a specific amino acid.

Interchanging menhaden fish meal and dehulled soybean oil meal

	Calories			Protein	Calcium	Inorg. Phos.	Meth. Cystine	Lysine
	M.E.	P.E.F.	P.E.T.	%	%	%	%	%
5% Fish meal	50	45	47	3.10	.25	.17	.137	.275
4% Corn	64	46	44	.34	..	..	.013	.008
Total	114	91	91	3.44	.25	.17	.150	.283
6.75% Soybean meal	77	43	53	3.44	..	..	.105	.216
1% Dicalcium phosphate	..	..	..	..	.26	.18	..	..
1.25% Tallow	41	36	36	..	..	..	..	..
Methionine	..	..	..	..	..	..	.045	..
Total	118	79	89	3.44	.26	.18	.150	.216

M.E. Metabolizable. P.E.F. Fraps productive. P.E.T. Fraps productive corrected by Titus.

2.41

By differentiation the optimum thickness T(optimum) of insulation to give a maximum value of W after a given time is determined as: T_o (optimum) $= \frac{tvK}{12D} = \frac{K}{K_o}$ inches.

By the methods of calculus, it will be seen that insulation becomes of value only after the time that: $\frac{tvK}{12D} = \frac{K}{K_o}$

Up to that time, more ice will be left in the box after a given time by using the insulation space for additional ice.

This was confirmed by filling a wooden box with dimensions $11\frac{1}{2} \times 15\frac{3}{4} \times 15\frac{1}{2}$ inches--one typical of the smallest size used in practice--with crushed trawler ice and measuring the meltage over given periods. A similar box was lined on the inside with high wet-strength corrugated cardboard 3/16 inch thick. It was found that the cardboard reduced the weight of ice that could be filled into the box from 61.6 pounds to 58.5 pounds. After 8 hours storage in an ambient temperature of about 60° F., the weight of ice left was the same in both boxes, that is, 52.0 pounds, and only from then onwards did the superior insulation of the cardboard-lined box have a telling effect on the weight of ice remaining. For instance, after 20 hours the weight of ice left was 39.0 pounds in the unlined box and 43.0 pounds in the lined box. By calculation, using formula 1, these figures work out at 40.6 and 42.1 pounds, respectively.

It appears that for journeys of medium duration (say up to 15 hours) no striking advantage can be expected from insulating wooden fish boxes, particularly if their initial cost is to be kept low, and if they should be of the nonreturn type. Other possible solutions which are being investigated include lining the boxes with aluminum or similar foil and increasing the bulk density of the ice.

7.80

difference between the normal and the spoiled samples.

Smoked fish.--The VRS values reflected the sensory judgment for smoked yellowtail (Seriola dorsalis) and canned kippered-herring snacks.

Canned fish.--Marked correlation of sensory judgment and VRS values was obtained with canned abalone in brine, jack mackerel in brine, and Pacific sardines in tomato sauce.

Discussion.-- The aim of workers, in the field of quality control and freshness determination of fishery products, has been to find or develop a general method that would be applicable to all kinds of fresh fish, to all kinds of processed fish, and to all storage conditions. Such a test would have to show the following: (1) good correlation with sensory judgment, (2) application to all types of spoilage that lead to definite sensory changes, (3) application to all varieties of lean and fatty or white- and red-fleshed fish and fish products, (4) as great a difference as possible between the amount of the compound upon which the test is based in fresh fish and that in spoiled fish, (5) a progressive change in the amount of spoilage compound during the course of spoilage, and (6) relative ease of operation in carrying out the test with simple and readily available apparatus.

The author believes that the VRS test satisfies these criteria and that his data substantiate his belief.

Conclusion.-- Of all the fish spoilage tests reported to date, the VRS method most closely approaches the specifications of a generally useful test for all kinds of fish and fish products and their diverse spoilage patterns under varying storage conditions.

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The chromatogram showed three or four incompletely separated components, which made it impossible to determine the identity of the components or to determine if qualitative differences occurred in the chromatogram during the period of spoilage. A correlation was observed, however, between the degree of spoilage of the fish and the quantity of individual volatiles.

Conclusion.--From the results of these experiments, it appears that gas chromatography might better be used in spoilage studies for the fractionation and estimation of specific classes of bacterial metabolites rather than of heterogeneous groups of metabolites.

Fractionation of Volatile Nitrogen

The principal constituents of the volatile nitrogen of fish are trimethylamine, ammonia, dimethylamine, and methylamine. In this investigation, it was desired to analyze the ammonia-amine mixture from fish as the free base.

Experimental method.-- The constituent volatile nitrogen compounds were extracted from the fish flesh with 60-percent ethanol in a blender. The extract was made alkaline with sodium borate; the free bases were steam distilled into dilute hydrochloric acid, concentrated by distillation, made alkaline with 10-percent potassium hydroxide, and quickly steam-distilled into a receving flask cooled with dry ice. The distillate was chromatographed immediately.

Results.--When the volatile nitrogen from refrigerated brine-chilled cod was fractionated by gas chromatography, three peaks appeared that apparently corresponded to those of trimethylamine, ammonia, and dimethylamine, respectively. The recovery of the volatile nitrogen chromatography from fish flesh ranged from 90 percent for samples high in volatile nitrogen to 76 percent for samples low in volatile nitrogen.

7.591 LINGCOD MUSCLE PURINE NUCLEOSIDE PHOSPHORYLASE

Tarr, H. L. A. (Fisheries Technological Station, Vancouver, B. C.)
Canadian Journal of Biochemistry and Physiology 36, 517-530 (1958)

Introduction.--During an investigation of the riboside hydrolase enzymes of the muscles of Pacific lingcod (Ophiodon elongatus) the author noticed that alcohol extracts of the tissues, when submitted to paper chromatography under appropriate conditions, contained small amounts of a substance with properties similar to those of ribose 1-phosphate. Subsequent experiments have shown that the muscles of this fish possess a purine nucleoside phosphorylase enzyme. Since initial brief communications concerning this enzyme were published by Tarr (1955 and 1956), Svard (1957) has shown that a guanosine phosphorylase is present in the skin of the roach (Leucisus rutilus). No information has been given regarding the substrate specificity of this enzyme.

Findings.--A purine nucleoside phosphorylase enzyme preparation that catalyzed the general reaction ribose (deoxyribose) 1-phosphate + purine ⇌ purine nucleoside (deoxynucleoside) + orthophosphate was isolated from muscles of the lingcod (Ophiodon elongatus). The reaction was found to be about 85 percent in favor of nucleoside synthesis with 10 μM./ml. concentrations of reactants in the hypoxanthine-inosine system. With similar concentrations of reactants in the guanine-guanosine system the equilibrium was about 75 percent in favor of nucleoside synthesis, and with considerably higher concentrations of reactants in this system this percentage decreased markedly.

Purified preparations were stable for over a year at -20° C., contained two major protein components (zone electrophoresis and ultracentrifuge data), were rather heat labile, and possessed a maximum activity corresponding to liberation of 32 μM. orthophosphate/mg. protein N/hour.

Evidence is given in support of the view that a single enzyme is responsible for the above

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 Reprinted in part

8.0 TECHNICAL NOTE NO. 47.--STEELHEAD TROUT DESCRIPTION AND PROXIMATE COMPOSITION

Iverson, John L. (Fishery Products Laboratory, Ketchikan, Alaska)
Commercial Fisheries Review 20, 26, 27 (November 1958)

The steelhead trout, Salmo gairdnerii, varies in size from one habitat to another. In marine waters, the mature steelhead is a metallic blue on the dorsal surface, silver on the sides, and silver-white on the ventral surface. These fish may be distinguished from similar salmon by the trout-like head and the black spots on dorsal surface and tail. Steelhead inhabit coastal streams from southern California to southeastern Alaska.

This paper reports the proximate analyses of 15 steelhead trout caught in salt water near Ketchikan, Alaska. (See table, over).

A representative portion of one fillet, with skin on, taken from each fish was analyzed for proximate composition, using standard techniques of the Association of Official Agricultural Chemists.

The yield of fillets varied from 49 to 73 percent and averaged 62 percent. The larger fish tended to give a higher yield of fillets and to contain more oil than did the smaller fish. Steelhead trout caught at another time and at another location might differ somewhat in proximate composition.

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 ABSTRACTER: Kathryn L. Osterhaug

8.0 VARIATIONS IN COMPOSITION OF SOUTHEASTERN ALASKA PINK SALMON

Thurston, Claude E. (Fishery Technological Laboratory, Bureau of Commercial Fisheries, Seattle, Washington)
Food Research 23, 619-625 (November-December 1958)

The composition of fish flesh depends on a variety of factors, such as (1) section of fish sampled, (2) sex, (3) size, (4) degree of maturity, (5) season of capture, and (6) geographical area of capture. To determine the influence of these factors, male and female pink salmon (Oncorhynchus gorbuscha) were taken at the beginning, middle, and close of the commercial fishing season near Ketchikan, Alaska, during the summer of 1956. The samples represented variations in size and in maturity.

Preparation of samples.--After the fish had been washed, measured, weighed, and scalded, the skin was removed, and a sample was taken from each of the following sections of each fish: steak sections from (1) nape, (2) center, and (3) tail; (4) dorsal strip; (5) belly flaps; (6) dark meat from sides of the unused parts; and (7) the remaining light meat.

Analytical procedure.--Moisture, oil, protein, and ash were determined in percent by standard methods of analysis of the Association of Official Agricultural Chemists. Sodium and potassium were determined in mg. per 100 g. by extraction of soluble salts from the ashed sample and then were read in a direct-reading flame photometer calibrated against a standard solution.

Discussion of results.--Wide variations in composition were found. Moisture varied from 44 to 84 percent. Oil ranged from 1.3 percent in the light meat to 43.3 percent in the dorsal parts. Protein varied from 9.6 to 22.0 percent, and ash varied from 0.75 to 1.68 percent. Sodium had a range of

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 ABSTRACTER: Claude E. Thurston

8.50 BIOCHEMICAL STUDIES ON SOCKEYE SALMON DURING SPAWNING MIGRATION. PARTS I, II, III, AND IV.

Idler, D. R.; Tsuyuki, H.; Bitners, I.; Duncan, D. W.; Tarr, H. L. A.; and Wood, J. D. (Fisheries Technological Station, Vancouver, B. C.)
I. Canadian Journal of Biochemistry and Physiology 36, 783-791 (August 1958); II. Ibid., 793-798; III. Ibid., 799-803; IV. Ibid., 833-838.

I. Physical measurements, plasma cholesterol, and electrolyte levels.--Physical measurements have been made on all major organs and tissues of a pure race of migrating adult Oncorhynchus nerka. A statistical analysis of weights and of measurements obtained from fish samples at three locations along the migration route show that the population was sufficiently uniform in size to accurately represent a standard fish of both sexes. The results will enable chemical analyses to be interpreted as changes in absolute amounts of a given tissue component rather than only on a percentage basis. The merits of this approach to an evaluation of changes in migrating salmon are demonstrated by the magnitude of the weight changes in many tissues during the 715-mile migration. A standard male lost only 11 percent of its body flesh, whereas a standard female lost 30 percent. The alimentary tract decreased to one-sixth of the initial weight. The milt increased by 51 percent, whereas the roe increased by 272 percent. Thus, it is apparent that percentage composition data cannot show quantitative changes in a fish as it moves up the river. The results are discussed in relation to the findings of others on Salmonidae. Plasma cholesterol, magnesium, calcium, sulphate, and urea levels were measured on pooled blood samples from 216 fish.

II. Cholesterol, fat, protein, and water in the flesh of standard fish.--The absolute changes in free and esterified cholesterol, fat, protein, and water in the flesh of standard male and female salmon during the spawning migration are discussed. The data were obtained for 12 groups of male and 12 groups of female sockeye representing 216 fish. Fish were caught at three locations:

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 Authors' summaries

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46 to 198 mg. per 100 g., and potassium varied from 123 to 321 mg. per 100 g.

The greatest variations were found in the dorsal strip, dark meat, and belly flap, which constitute a minor part of the edible flesh. Composition of the steak sections was fairly constant and ranged as follows: moisture, 74 to 79 percent; oil, 1.8 to 4.9 percent; protein, 18.2 to 20.6 percent; ash, 1.08 to 1.29 percent; sodium, 61 to 95 mg. per 100 g.; and potassium, 261 to 281 mg. per 100 g.

Variations in composition with time of capture were not great, since the commercial season covered a period of only 4 weeks. The difference between small and large prime specimens of the same degree of maturity was less than the difference between prime and mature specimens regardless of size. Variations with maturity were very pronounced and were greatest in oil content. In specimens about to die, nearly all the oil had been consumed except in the lateral part, which had lost about half of its maximum amount. The amount of protein in these fish had decreased, and the amount of moisture had increased.

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(1) below the entrance to the river, (2) 250 miles up the river, and (3) at the spawning grounds, which were 715 miles from the first sampling station.

III. Changes in the protein and nonprotein nitrogen fractions in muscles of migrating sockeye salmon. -- The nitrogen content of three protein fractions and one nonprotein nitrogen fraction of muscles of migrating sockeye salmon was determined at three points on the migratory route. The results have been expressed as milligrams of nitrogen per 100 grams of muscle, as percent of the total muscle nitrogen, and as grams of nitrogen per average (standard) male or female fish.

IV. The nonprotein nitrogenous constituents of the muscle. --The nonprotein nitrogenous constituents of muscle from migrating sockeye salmon were investigated. These constituents were found to be the same in both male and female fish and were present in approximately the same amounts in both sexes. The histidine content of the muscle in all fish decreased to one-fifth of the original value during the early stages of the migratory journey and remained at a low level thereafter. Some of the other constituents changed to a smaller extent, usually increasing in the later stages of the migration. This was especially noticeable in female fish. However, the increase in the concentration of these constituents in the muscle was due to a decrease in the amount of muscle in the fish rather than to an increase in the amounts of the compounds themselves.

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reaction and that it possesses strict specificity for α-D-ribofuranose 1-phosphate and deoxyribose 1-phosphate. Of a large number of substituted purines investigated, only the following were active: hypoxanthine, xanthine, 6-mercaptopurine, 6-methylpurine, 8-azaguanine, guanine, adenine, and 2, 6-diaminopurine.

Methods are given for the preparation, in good yield, of analytically pure dicyclohexylammonium salts of ribose 1-phosphate and deoxyribose 1-phosphate.

8.0 (Cross Reference: 1.37)

Table 1 - Proximate Composition of Fillets from Steelhead Trout (Salmo gairdneri) Caught in Salt Water Near Ketchikan, Alaska

Date Caught	Sample[1/]	Length	Weight	Fillet Yield	Proximate Composition			
					Protein	Oil	Moisture	Ash
	Number	Inches	Pounds		(Percent)			
August 1953	1	29	8.6	70	22.8	8.6	68.2	1.34
	2	25	6.6	73	20.8	16.4	62.8	1.23
	3	27	5.9	71	22.0	11.8	66.4	1.28
	4	22	3.7	71	22.2	10.1	67.8	1.24
August 8, 1957	1	26.5	8.6	70	21.5	12.2	65.0	1.28
	2	24.0	7.0	70	22.4	11.2	66.2	1.35
	3	22.5	5.4	68	19.2	9.7	69.7	1.30
	4	24.0	6.4	65	22.3	10.6	65.5	1.29
	5	24.0	6.0	69	21.5	8.7	68.6	1.40
August 23, 1957	1	18.0	4.4	50	20.0	6.6	72.0	1.30
	2	17.5	4.0	49	20.2	6.4	71.2	1.32
	3	17.5	4.2	52	19.9	8.1	71.5	1.30
	4	17.5	4.3	52	22.5	7.2	69.8	1.22
	5	14.0	2.5	50	19.0	9.8	69.4	1.34
	6	17.5	4.4	52	22.7	8.2	68.3	1.40
Average		21.7	5.5	62	21.3	9.7	68.2	1.31

1/Each sample is a representative portion of one fillet (skin on) from one fish.

8.42 VARIATIONS IN THE SODIUM AND POTASSIUM CONTENT OF THE MUSCLE TISSUE OF PACIFIC SALMON WITH PARTICULAR REFERENCE TO MIGRATION

MacLeod, Robert A.; Jonas, R. E.; and McBride, J. R. (Fisheries Research Board of Canada, Technological Station, Vancouver, B. C.)
Canadian Journal of Biochemistry and Physiology 36, 1257-1268 (December 1958)

Introduction.--In a previous investigation, a survey was made of the sodium ion and potassium ion content of the flesh of fish caught in commercial quantities along the coast of British Columbia. Considerable variation exists in the levels of these ions in the flesh of salmon, and these levels appear to depend on the size of the salmon and the season of the year. The authors speculated that the change with season might be related to the approach of the salmon to the time of their spawning migration. The present study was undertaken to explore this possibility further.

Source of materials.--Salmon from the sea were obtained directly from fishing boats. Spring salmon (Oncorhynchus tschawytscha) caught at various points on the Fraser River were obtained through the cooperation of the Department of Fisheries at Vancouver and the Biological Station at Nanaimo. The salmon were placed individually in polyethylene bags as caught, and the bags packed in ice for transport to the laboratory. This arrangement prevented possible leaching of the salmon by the melting ice.

Sockeye salmon (Oncorhynchus nerka) were obtained through the cooperation of the International Pacific Salmon Fisheries Commission. The sockeye collected in 1956 were transported in the same manner as the spring salmon. In 1957, however, the sockeye were bled, frozen in dry ice at the site of capture, and transported to Vancouver in a portable deep-freeze unit.

Methods of sampling and analysis.--All salmon were eviscerated and then sampled according to a slight modification of the official A. O. A. C. method. Three slices were removed from each salmon: one from behind the head, one from the mid-section, and one from just in front of the tail. The muscle tissue from each slice was separated from the bones and skin, pooled, and homogenized. Aliquots of the homogenized samples were digested with nitric acid. Analyses were performed with

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 ABSTRACTER: Martin Heerdt

8.51 CONTENT OF FREE IMIDAZOLE COMPOUNDS IN THE MUSCLE TISSUE OF AQUATIC ANIMALS

Lukton, A. and Olcott, H. S. (University of California, Berkeley)
Food Research 23, 611-618 (November-December 1958)

Introduction.--Jones (1955) recently demonstrated that the muscle tissues of cod contain anserinase, an enzyme that hydrolyzes the dipeptide anserine to its constituent amino acids, 1-methylhistidine and β-alanine. This enzyme continues to act in sterile cod flesh during storage and offers promise in the development of methods for following fish-handling practices independent of microbiological spoilage. The authors therefore were interested in learning if anserinase occurs in tuna. Preliminary observations indicated no detectable anserinase activity, but they did indicate unexpectedly large amounts of anserine in tuna. The survey reported in this paper was made to obtain more complete information on the distribution of anserine and related imidazole compounds in the muscles of aquatic animals.

Preparation of extracts.--Tissues analyzed were obtained from a number of sources, including local fish markets. Five grams of muscle was extracted with 50 milliliters of 1-percent picric acid in a Waring Blendor, as described by Hamilton (1945). The extract was filtered using suction and, with the washings, was freed of picric acid by passing it through a Dowex-2 column as described by Tallan et al. (1954). The effluent was evaporated to a small volume in a rotary evaporator, diluted quantitatively to 5 to 25 milliliters, and either analyzed immediately or held frozen until needed. An extract obtained with 80 percent alcohol was found to contain the imidazole compounds quantitatively.

Analytical methods.--The ion-exchange column procedure of Davey (1957) was used with a 65-cm. column. Column preparation with Dowex 50-X4 and operation procedures were those of Moore and

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 ABSTRACTER: Martin Heerdt

8.59 NITROGEN EXCRETION IN SOME MARINE TELEOSTS

Wood, J. D. (Fisheries Research Board of Canada, Technological Station, Vancouver, B. C.)
Canadian Journal of Biochemistry and Physiology 36, 1237-1242 (December 1958)

Introduction.--Excreta of marine teleosts have been studied extensively, and particular attention has been paid to trimethylamine oxide (TMO) because it is reported as: (a) a nontoxic end-product of protein metabolism, (b) important in osmoregulation, and (c) of exogenous origin, being obtained from the food of the fish.

Purpose.--The present experiments were carried out to determine the composition of the excreta from different species of marine teleosts with reference to TMO. The species used were sculpin (Leptocottus armatus), starry flounder, (Platichthys stellatus), and blue sea perch (Taeniotoca lateralis) all of which were caught in the Straits of Georgia, British Columbia, kept in aquaria, and fed on pieces of lingcod muscle.

Collection of excreta.--Each fish under study was placed in a tank slightly larger than itself. Then sufficient sea water was added to the tank to cover the fish. This water was kept well aerated and at 12° C. After 24 hours, the fish was removed from the tank. The water then was acidified with a small amount of HCl and evaporated to dryness in vacuo at 45° C. The nonprotein nitrogenous compounds were separated from the inorganic salts with four successive extractions of 80-percent ethanol. The ethanol extracts then were combined, filtered, and evaporated to dryness in vacuo at 45° C. The residue was redissolved in water to yield a final volume of 50 milliliters. With this procedure, the authors obtained 97-percent recovery of known amounts of ammonia, urea, trimethylamine (TM), TMO, and creatine dissolved in sea water.

Analyses.--Total N was estimated by using the micro-Kjeldahl method as adapted by Ma and

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 ABSTRACTER: Martin Heerdt

8.59 MARINE STEROLS. PARTS I, II, III, AND IV.

Idler, D. R. and Fagerlund, U. H. M. (Fishery Technological Station, Vancouver, B. C.)
Journal of the American Chemical Society 77, 4142 (1955) FRB No. 406; II. Journal of Organic Chemistry 21, 372 (1956) FRB No. 433; III. Journal of the American Chemical Society 79, 1988 (1957) FRB No. 470; IV. Ibid. 6473 (1957) FRB No. 498

I. Isolation of 24-methylenecholesterol from molluscs.--A new sterol, 24-methylenecholesterol, has been isolated by a chromatographic separation of the azoyl esters prepared from the sterols of the oyster (Ostrea gigas) and the clam (Saxidomus giganteus). Oyster and clam sterols contain 36 and 53 percent, respectively, of this sterol.

II. 24-methylenecholesterol in molluscs.--This paper reports the occurrence of 24-methylenecholesterol in three other members of the class pelecypoda: scallop (Pecten caurinus), cockle (Cardium corbis), and in a commercially prepared mixture of crude sterols from the mussel (Modiolus demissus).

The chromatographic pattern of p-phenylazobenzoyl (azoyl) esters of scallop, cockle, and mussel sterols resembled that from oyster and clam. The minor top zone ($\Delta^{5,7}$-sterol) was absent, zone 1 consisted of 24-methylenecholesterol, zone 2 of a diunsaturated sterol, and zone 3 of a monounsaturated sterol.

The identity of these bands with the corresponding bands in the chromatogram of oyster and clam sterol azoyl esters was indicated by a comparison of the infrared spectra of the free sterols.

III. The synthesis of 24-methylenecholesterol and 25-dehydrocholesterol.--A new sterol,

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 Authors' summaries

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Stein (1954). One-milliliter fractions were obtained at the rate of five per hour with an automatic collector. Elution peaks for histidine, methylhistidine, carnosine, and anserine were usually at 50, 56, 80, and 90 milliliters, respectively. Amino acid and peptide concentrations were determined as described by Yemm and Cocking (1955), with a modification suggested by Davey.

Several different techniques were used to identify with certainty the nature of the amino acids and peptides in the extracts. The positions of the elution peaks were determined both by chromatography of known substances alone and in mixtures and after addition to extracts. Histidine and carnosine were determined quantitatively by the Pauly diazotized sulfanilic acid reaction as well as with ninhydrin. The reagent used was that described by Fraenkel-Conrat and Singer (1956). Arginine was estimated in an aliquot of the protein-free extract by the method of Ceriotti and Spandrio (1957). Nitrogen was determined by the micro-Kjeldahl technique.

Results.--In control experiments, the average recovery of four imidazole compounds added either alone or in mixtures to the column was 96 percent, with a range of 78 to 114 percent. Single determinations were subject to as much as 50-percent error, but the method was considered adequate for the survey. A total of 23 species of marine fish, two elasmobranchii, six fresh-water fish, and six molluscs and crustacea were assayed. Relatively large amounts, or 10 to 50 micromoles per gram each of anserine and histidine, were found in the four species of tuna studied. Light-colored tuna muscles contained more imidazole than did red muscle. Salmon, swordfish, and sablefish had large amounts of anserine only, or 11 to 25 micromoles per gram. Mackerel, sardine, and menhaden contained large amounts of histidine only, or 15 to 49 micromoles per gram. Barracuda, shad, and one carp contained intermediate amounts of histidine. Only true cod and two species of salmon had appreciable amounts of methylhistidine. Carnosine was the most important imidazole found in the whales. Less than 1 micromole of arginine per gram of wet tissue was present in all samples except crab, shrimp, and squid, which contained respectively, 4.0, 1.6, and 1.4 micromoles per gram.

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24-methylenecholesterol, recently isolated from several molloscus has been synthesized from 24-ketocholesterol employing triphenylphosphinemethylene. The synthesis of 25-dehydrocholesterol is also reported, and discrepancies in its properties with the products previously assigned this structure are discussed. Evidence is presented to support the conclusion that the earlier preparations are not 25-dehydrocholesterol, and it is suggested that they are the previously undescribed 24-dehydrocholesterol. The broader implications of the use of triphenylphosphine alkylidene compounds in synthesis in the sterol side chain are outlined.

IV. 24-dehydrocholesterol: Isolation from a barnacle and synthesis by the Wittig reaction.--The new sterol, 24-dehydrocholesterol, has been isolated from the barnacle (Balanus gladula). It represents 34.2 percent of the total sterols of the barnacle. The major component, cholesterol, represents 59.8 percent of the total sterols. The new sterol also has been synthesied via the Wittig reaction, and the synthetic product has been shown to be identical with the natural one. A previously reported sterol obtained by the dehydrohalogenation of 25-bromocholesterol and assigned the structure 25-dehydrocholesterol has been shown to be a mixture of 40 percent 25-dehydrocholesterol and 60 percent 24-dehydrocholesterol.

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the aid of a flame photometer attachment to a Beckman DU spectrophotometer. Details of these procedures have been described by McBride and MacLeod (1956). Fat analyses were performed by the method of Damberg (1956).

Results.--Data obtained supported the previous observation that the level of sodium and potassium ions in the muscle tissues of spring salmon on the Pacific coast varies with the size of the fish and, in the case of small fish, with the season of the year. Small salmon weighing 3 to 5 pounds and caught in regions of relatively constant salinity had a higher sodium ion content and a lower potassium ion content in the spring and summer than they had in the fall and winter. Larger salmon weighing 9 to 10 pounds did not show a variation in sodium and potassium ion content with the seasons of the year.

Spring salmon sampled along the route of their spawning migration up the Fraser River had a lower sodium ion content at the mouth of the river than they had at sea. The sodium ion content of spring salmon taken further up the river dropped to less than one-half of the value at sea. In three out of four groups examined at the spawning grounds, the sodium ion content rose again to levels equal to or above those prevailing at sea. In general, a drop in sodium ion content was accompanied by a rise in potassium ion content and vice versa; however, at the spawning ground the drop in potassium ion content considerably exceeded the rise in sodium ion content.

Sockeye salmon (Oncorhynchus nerka) heading up river showed a decrease in the sodium ion content and an increase in the potassium ion content of their muscle tissue while they were still in salt water. After they had entered fresh water, their sodium and potassium ion levels were restored and maintained at levels similar to those normally prevailing at sea. At or near the spawning ground the sodium ion content increased and the potassium ion content decreased. Evidence of this change was obtained in the male of the species.

The flesh of juvenile coho salmon (Oncorhynchus kisutch) migrating to the sea was found to contain less sodium ion and more potassium ion than mature fish of the same species caught at sea. Young sockeye in fresh water, however, contained about the same levels of sodium ion and potassium ion as the mature fish at sea.

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Zuazaga (1942). Ammonia-N, TM-N, and TMO-N were determined by the method of Ronold and Jakobsen (1947). Urea-N was measured by the methods of Fearon (1939) and Koritz and Cohen (1954), and good agreement was obtained between the two methods. Creatine-N and creatinine-N were estimated by the method of Bonsnes and Taussky (1945).

Results.--The excreta from seven sculpins, two starry flounder, and a blue sea perch were investigated. In all cases the major components of the excreta were ammonia and urea, but the total amount excreted varied considerably between fish of the same species. When the results obtained are converted to percentages of the total N excreted, as is shown in tabular form (see below), the ammonia and urea contents of the excreta were found to remain reasonably constant within any one species, even when the size of the fish varied considerably. The same constancy of composition, however, did not hold from species to species. The average undetermined N values in the excreta of the sculpin, starry flounder, and blue sea perch were 13 percent, 3 percent, and 13 percent, respectively. A single sculpin excreted 77 percent of its nitrogenous material via the gills and 33 percent via the kidneys. Uric acid and amino acids were not detected in the excreta. The effects of bacterial action on the excreta in the sea water were found to be insignificant.

Percentage composition of excreta from marine teleosts

	Sculpin							Starry flounder		Blue sea perch
Ammonia-N	52.6	62.6	67.4	72.4	66.6	62.3	55.3	86.2	81.4	48.0
Urea-N	22.5	20.5	24.7	17.3	16.9	24.0	19.4	11.5	12.1	38.1
Trimethylamine-N	0.0	1.3	1.6	1.4	1.8	2.8	1.9	1.1	0.2	0.3
Trimethylamine Oxide-N	2.2	0.0	1.3	3.8	0.8	0.0	0.2	0.5	0.0	0.4
Creatine-N + creatinine-N	0.4	--	0.9	0.7	0.5	1.1	1.4	0.3	0.1	0.0
Undetermined N	22.3	15.6	4.1	4.4	13.4	9.8	21.8	0.4	6.2	13.2

8.59 FREE SUGARS IN CHILL-STORED, TRAWLED CODLING (GADUS CALLARIAS) MUSCLE

Jones, N. R.
Journal of the Science of Food and Agriculture 9, 672-677 (October 1958)

Purpose.--The present paper (1) describes changes in free sugars that occur in fish during commercial chill-storage and (2) attempts to distinguish between the effects of autolytic decomposition, bacterial decomposition, and leaching of the flesh. This study is a part of a program undertaken to explain the changes in flavor that occur during chill storage and the considerable variations in brown discoloration that occur when chilled fish is dehydrated or salted and subsequently stored.

Experimental.--Codling, 18 to 24 inches in length, were trawl-caught in Aberdeen Bay. Fresh codling controls for immediate analysis were killed by a blow on the head. Codling other than for fresh controls were eviscerated and packed in ice ashore at an ambient temperature of 2.5°C. to simulate commercial trawler conditions. In the preparation of samples, codling were skinned and filleted; and 10 grams (g.) of muscle was immediately dissected from the anterio-dorsal part of the fillet. The muscle was homogenized in 32 milliliters (ml.) of ethanol, centrifuged at 800 times gravity, and re-extracted three times with 80-percent volume for volume ethanol to a total extract volume of 250 ml. This procedure assumed 80-percent weight for weight of water in the muscle, but moisture determinations were carried out to correct subsequent calculations. Chloroform in the amount of 150 ml. was added to 50-ml. aliquots of the aqueous ethanol extracts, and the upper, aqueous phase that separated was removed for resin treatment.

Muscle blocks, weighing 1.0 ± 0.05 g., from the same fillet were suspended individually in 50 ml. of sterile water containing 2 drops of toluene and 2 drops of chloroform to suppress the growth of bacteria. Similar blocks were inserted into tightly fitting tubes and immersed in 0.5 ml. of sterile 0.2M-sodium chloride with 1 drop of toluene and 1 drop of chloroform as controls. This concentration of ions simulated that in the muscle. Periodically, pairs of experimental blocks were removed.

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ABSTRACTER: Martin Heerdt

8.8 CHARACTERIZATION OF THE RED PIGMENT FORMED IN THE 2-THIOBARBITURIC ACID DETERMINATION OF OXIDATIVE RANCIDITY

Sinnhuber, Russell O.; Yu, T. C.; and Yu, Te Chang (Oregon State College, Corvallis)
Food Research 23, 626-633 (November-December 1958)

The pure crystalline 2-thiobarbituric acid (TBA) pigment was prepared as purple black needles from rancid salmon oil, sulfadiazine and the acid hydrolysis product of 1, 1, 3, 3-tetraethoxypropane, malonaldehyde. The results obtained by elemental analyses, absorption spectrophotometry, and paper chromatography all suggest the pigments are identical. The data indicate that the crystalline pigment is a condensation product of one molecule of malonaldehyde with two molecules of TBA and the probable elimination of two molecules of water. From these results and the data on yields and combining ratios, a structural formula is proposed and the empirical formula, $C_{11}H_8N_4O_4S_2$ or $C_{11}H_8N_4O_4S_2 \cdot H_2O$, is presented. Visible and ultraviolet spectrophotometry of the pigment confirm the primary maxima at 532 to 535 mμ with an average $E^{1\%}/1cm.$ of 4780 at a pH of 0.9. Secondary maxima are evident at 245 mμ and 305 mμ.

Most of the TBA reactive material is present in rancid salmon oil as complex compounds, possibly acetals, which are not volatile in a stream of nitrogen. However, upon the addition of hydrochloric acid, the TBA reactive material, probably malonaldehyde, may be removed by a stream of nitrogen. A small amount, 2 percent, appeared to be present as the free malonaldehyde.

Sulfadiazine reacts with TBA in a hydrochloric acid media to yield the identical pigment. The mechanism of the cleavage of the pyrimidine ring to yield a 3-carbon fragment remains to be explained.

Reprinted in part

8.59 MARINE FISH MUSCLE NUCLEIC ACIDS

Bluhm, H. M. and Tarr, H. L. A. (Fisheries Technological Station, Vancouver, B. C.)
Canadian Journal of Biochemistry and Physiology 35, 767-769 (1957)

Introduction.-- The occurrence of free ribose in fish muscles stored at 0°C. for several days post-mortem was first demonstrated by Tarr (1953). The role of riboside hydrolase enzymes in the formation of free ribose was established later. During these investigations the senior author observed that alcoholic extracts of post-rigor marine fish muscles contained significant quantities of ribonucleosides that were not evident in the muscles of freshly killed fish.

Purpose.--The present paper records the quantitative distribution of ribonucleic acid (RNA) and deoxyribonucleic acid (DNA) in the muscles of six species of North Pacific ocean fish and describes the isolation and chemical characterization of RNA from sockeye salmon and from lingcod.

Materials and methods.--Whole small fish, or pieces of excised muscle from larger fish, were frozen in crushed, solid carbon dioxide as soon after capture as possible, wrapped in polyethylene, and stored at -25°C. until they were used. Frozen samples of the muscles were homogenized in cold 75-percent ethanol and fractionated by the method of Ogur and Rosen (1950). The RNA and DNA content of the tissues was calculated from quantitative determinations of the ribose and deoxyribose content of appropriate fractions. Only the method of Volkin and Carter (1951) was satisfactory for extracting RNA from the frozen samples. The actual yields of RNA by this technique were only 20 to 25 percent of the calculated RNA content of the muscles. When freeze-dried from aqueous solution, however, sodium RNA was obtained as a fluffy, white, completely water-soluble product of high purity.

In order to determine the purine and pyrimidine bases, the RNA samples were hydrolyzed 1 hour

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ABSTRACTER: Martin Heerdt

9.17 OLFACTORY PERCEPTION IN MIGRATING SALMON. I. l-SERINE, A SALMON REPELLENT IN MAMMALIAN SKIN

Idler, D. R.; Fagerlund, U. H. M.; and Mayoh, Helen (Pacific Fisheries Experimental Station, Vancouver, B. C.)
Journal of General Physiology 39, 889-892 (July 20, 1956)

Introduction.-- A repellent to migrating coho (Oncorhynchus kisutch) and spring (Oncorhynchus tshawytscha) salmon existing in the skin of predators was reported by Brett and MacKinnon (1953). The repellent, estimated to be active at a concentration of one part in several million parts of water, halted upstream movement for at least 5 minutes and sometimes longer. Fish exposed to the repellent displayed an alarm reaction characterized by rapid movements, and on some occasions they retreated to a pool at a lower level. The second phase of their reaction involved a keen alertness to slight disturbances in the water. After a period of time without further exposure to the repellent, the fish resumed their ascent. A rinse of human hands now has been shown to contain a repellent for all five species of migrating salmon found in the Pacific northwest. These include coho, spring, chum, sockeye, and pink salmon.

Experimental.-- A source of repellent in sufficient quantity for identification studies was obtained from samples of seal and sea-lion skin that were dehaired, defatted, ground in a Waring blendor, and thoroughly extracted with water. Each extract was prepared from 25 grams of skin and made up to a final volume of 265 milliliters (ml.). Aliquots were taken, and the solution introduced from waxed containers into the water entering the top pool of the fish ladder.

Hand rinses were prepared by submersion of the hands for 2 minutes in 1 liter of water. The washings from human hands then (1) were dialyzed, (2) were concentrated to about 50 ml., and (3)

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ABSTRACTER: Martin Heerdt

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at 100° in 70-percent perchloric acid according to the method of Wyatt (1951). The free bases were separated by quantitative paper chromatography with isopropanol:HCl:H_2O solvent and with 16-hour ascending development at room temperature. The compounds were located on the air-dried chromatograms with an ultraviolet lamp. Their concentrations were determined by elution with 0.1 N HCl for 18 hours at room temperature and by application to the eluates of the differential ultraviolet spectrophotometric method of Vischer and Chargaff (1948). The nitrogen content of purified lingcod RNA was determined by the micro-Kjeldahl procedure, and the phosphorus content was determined by the method of Fiske and Subbarow (1925). A quantitative biuret test of the lingcod RNA and chromatography of its acid hydrolyzates were employed in attempts to demonstrate the presence of protein and amino acids in the respective materials.

Results.--The muscles of sockeye salmon (Oncorhynchus nerka), spring salmon (Oncorhynchus tschawytscha), pink salmon (Oncorhynchus gorbuscha), coho salmon (Oncorhynchus kisutch), lingcod (Ophiodon elongatus), and starry flounder (Platichtys stellatus) on the basis of 100 mg. of tissue contained respectively, 100, 142, 42, 123, 47.3, and 58.0 micrograms of RNA and 2.5, 1.4, 0.2, 1.5, 1.0, and 2.0 micrograms of DNA.

The molar ratio of purine and pyrimidine bases of the RNA prepared from lingcod and sockeye salmon muscles was practically identical and approximately as follows: adenine, 1.0; guanine, 2.0; cytosine, 1.0; and uracil, 1.25. By comparison, the molar ratio of the purine and pyrimidine bases of carp muscle nucleotropomyosin was as follows: adenine, 1.0; guanine, 2.1; cytosine, 1.85; and uracil, 1.1. A detailed chemical analysis of lingcod RNA showed (1) that the ratio of purines to pyrimidines is somewhat higher and (2) that the ratio of nitrogen to phosphorus is somewhat lower than has been recorded for yeast RNA. Only minute traces of amino acids other than glycine, which is derived from acid hydrolyzed purines, were found in treated preparations.

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were passed through beds of resin 1 inch by 12 inches. The resin bed then was washed with 3 volumes of distilled water, and the eluate was tested for activity. Only strongly acidic and strongly basic resins were able to bind the repellent.

The active component of human skin, seal skin, and sea-lion skin is water-soluble and partitions into the aqueous phase from diethyl ether and n-butanol. It is stable to prolonged soxhlet extraction, and it is not destroyed at pH 2 or 11 on standing 2 days at room temperature. The repellent is not steam volatile, is not destroyed by steam distillation, and is not volatile if placed on a boiling water bath at a pressure of 25 millimeters of mercury. The repellent is dialyzable, and dialyzed concentrates have been stored in the frozen state for many months without loss of activity. Repellent activity is not destroyed by a wide variety of proteolytic enzymes.

Paper chromatograms were run on the active fraction from continuous paper electrophoresis. Solvent systems used were pyridine-H_2O (acetic acid vapor); tertiary butanol-formic acid; phenol-water, and butanol-acetic acid water. Serine was identified as a major component of the active fractions. Four other ninhydrin-postive compounds were present, three of which were identified as valine, leucine (or isoleucine), and cysteine. A compound which appears close to serine in several solvents has not yet been identified.

Results with salmon.--In preliminary tests carried out at the fish ladder, l-serine was active at a dilution similar to the estimated concentration of the natural repellent. The d-isomer of serine, however, showed no activity. The l-isomers of the other identified, as well as closely related, amino acids were inactive. Material to be tested was introduced upstream in order to reach coho salmon ascending Sweltzer Creek, near Cultus Lake, British Columbia, at a constriction adjacent to a sandbar. A hand rinse immediately scattered the salmon back downstream, and they returned in about 5 to 10 minutes. l-Cysteine, l-leucine, l-isoleucine, l-valine, l-methinine, and l-cystine were all inactive when introduced at levels of 10, 5, 1, and 0.5 milligrams per 180 ml. of water introduced into the stream. l-Serine definitely elicited a typical alarm reaction at an extreme dilution, but the effects were neither so dramatic nor of so long a duration as the response obtained by a hand rinse.

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One of these was used for scaled-down sugar analysis, whereas the other was used for moisture analysis. The total contents of the control tubes were analyzed.

Resin treatment.--The upper or aqueous phase, which separated from ethanol extracts after the addition of chloroform, was shaken for 15 minutes with 2 g. of a resin mixture of 1:1 weight for weight of Amberlites IR-120 (H^+, 100 to 200 mesh) and IR-4B (OH^-, 60 to 200 mesh) to remove amino compounds and salts that would interfere with quantitative chromatography. Aliquots of 8 ml. of supernatant extract obtained after centrifuging were lyophilized and stored at -2° C.

Chromatography.--Lyophilized, resin-treated extracts were dissolved in 200 microliters (μl.) of water, and aliquots (the volume of which was determined by initial trial to fall within the range of 2 to 20 micrograms) were applied at the chromatogram start-line on No. 1 Whatman paper in successive 3-μl. droplets with a microsyringe. Ribose and glucose standards were applied to the same No. 1 Whatman paper. Chromatograms were run for 30 hours in butanol-acetic acid, dried in hot air, and sprayed with aniline hydrogen phthalate reagent. Spots were developed at 105° C. and eluted with 2 ml. of acetic acid for absorptiometric evaluation at 480 millimicrons in a Hilger 'Spekker' with microcell attachment.

Results with free sugars.--Glucose and ribose were the only sugars found on chromatograms of fresh and spoiling codling muscle. The levels of these two sugars varied considerably from fish to fish after chill storage, but trends were noticeable. Glucose levels remained almost constant for the first 6 to 8 days and subsequently fell rapidly to near-zero value at 15 to 20 days. Free ribose was absent from the fresh muscle and did not appear during the first day's storage. Thereafter, ribose values rose to a peak at 11 to 12 days but later tended to fall again. Levels of both glucose and ribose fell in comparison with those of unleached muscle from the same fish at 0° C. The results are expressed as differences after deducting control blanks to distinguish the effects of leaching alone on the composite multi-enzyme system.

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0.34 CHITIN

Tracey, M. V. (Rothamsted Exptl. Sta., Harpenden, England)
Revs. Pure and Appl. Chem. (Australia) 7, 1-14 (1957)
Chemical Abstracts 51, 12166 (August 25, 1957)

Review with 74 references.

0.34 NOTE ON THE THERMAL DECOMPOSITION OF UREA IN THE MUSCLES OF SHARKS

Suyama, Michizo and Tokujiro, Tadashi (Tokyo Univ. Fisheries, Kurihama)
J. Tokyo Univ. Fisheries 41, 45-52 (1954)
Chemical Abstracts 52, 20704 (November 25, 1958)

0.38 DEOXYRIBOSE-1 : 5-DIPHOSPHATE

Tarr, H. L. A. (Technological Station, Fisheries Research Board of Canada, Vancouver, B. C.)
Chemistry and Industry No. 18, 562-563 (May 4, 1957)
Studies 1957 from the Stations of the Fisheries Research Board of Canada, FRB No. 480 (Ottawa)

During a study of fish-muscle purine riboside phosphorylase it was found that the crude enzyme preparations possessed phosphoribomutase activity, and that incubation mixtures of equimolar quantities of dicyclohexylammonium DR-1-P and tetracyclohexylammonium R-1 : 5-P_2 with this enzyme yielded six compounds as indicated by paper chromatography and by colorimetric analyses of the eluates for deoxyribose, ribose, and acid labile and comparatively acid stable phosphorus.

0.38 ENZYMIC STUDIES ON THE GLYCOLYSIS OF FISH MUSCLE I. ACTIVITY OF PHOSPHORYLASE

Ono, Tokyi; Nagayama, Fumio; Osawa, Hirozo; and Takahashi, Bunichiro
J. Tokyo Univ. Fisheries 43, 37-47 (1957) (In English)
Chemical Abstracts 52, 20695 (November 25, 1958)

Phosphorylase prepared from fresh sea bass muscle had a pH optimum of 6.4, similar to the mammalian enzyme. The enzyme lost its activity rapidly when stored at 25°, disappearing completely after 6 hours. Extracts of slightly aged muscle had a more phosphorylase activity at 0° than had fresh muscle. Dorsal muscles had a slightly higher concentration of the enzyme than other parts.

2.01 A NATIONAL TYPE CULTURE COLLECTION OF MARINE BACTERIA

Shewan, J. M.; Floodgate, G. D.; and Hayes, P. R.
Nature 182, 1423-1424 (November 22, 1958)

(Abstract of this article appears under 0.5 page 1 - March 1959)

2.01 THE SOFTENING DETERIORATION OF FISH SAUSAGE I. SOME CHEMICAL AND MICROSCOPICAL ASPECTS

Uchiyama, Hitoshi and Tanaka, Takeo; Yokoseki, Motonobu; and Mamizuka, Toshiaki (Tokai Regional Fisheries Research Laboratory)
Bulletin of the Japanese Society of Scientific Fisheries 24, No. 2, 148-155 (1958) (English abstract, figures, and tables)

Fish sausage is manufactured essentially from fish meat, a small amount of potato starch, and pork fat. The softening of the sausage seems to be effected through the disintegration of the starch granules.

II. Microbiological studies of the softening deterioration. -- Ibid. 156-160. From the results of morphological and physiological experiments, the strains of micro-organisms are almost wholly identified as Bacillus circulans. All of the strains may be looked upon as facultatively anaerobic and characterized by their resistance to heat.

2.1121 AN EXPERIMENT ON A MIDWATER TRAWL V. EXPERIMENTS ON FULL-SIZED MIDWATER TRAWL GEAR AT SEA

Kobayashi, Kiichiro and Inoue, Naoichi
Bulletin of the Faculty of Fisheries Hokkaido University 9, No. 1, 59-65 (May 1958) (English abstract, figures and table)

This gear had a good stability and good net form, and the depressors and otter boards were effective; it was possible to tow the net at any depth by adjusting the warp length.

2.1121 ON THE RELATION BETWEEN THE LENGTH OF GROUND ROPE OF A DANISH SEINE AND THE VARIATION OF ITS GAPE

Suzuki, Otohiko (Department of Fisheries, Faculty of Agriculture, Kyoto University, Maizuru, Japan)
Bulletin of the Japanese Society of Scientific Fisheries 23, No. 9, 514-517 (1958) (In English)

The behavior of the closing action of the seine with different lengths of ground rope and with different towing speeds were studied by means of a model test. In general, a long ground rope causes a slow closing of the wings. The area swept by the foot rope appears to be wider with a longer ground rope.

2.1121 A MODEL EXPERIMENT FOR TRAWL NETS

Honda, Katsuji
Bulletin of the Japanese Society for Scientific Fisheries 23, No. 10, 608-611 (1958) (English abstract, figures, and tables)

State of deformation of the nets and water resistance acting on them were observed.

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Analyst
Analytical Chemistry
Archives of Biochemistry and Biophysics
Biochemical Journal
Biochemistry
Bulletin of the Faculty of Fisheries, Hokkaido University
Bulletin of the Japanese Society of Scientific Fisheries
California Fish and Game
Canadian Fisherman
Canadian Journal of Chemical Engineering
Canadian Journal of Chemistry
Canner and Freezer
Chemical Abstracts
Chemical and Engineering News
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Chemical Processing
Chemistry and Industry
Commercial Fisheries Review
Drug and Cosmetic Industry
FAO Fisheries Bulletins
Federation Proceedings
Feed Bag
Feedstuffs
Fisheries Newsletter (Australia)
Fish. Res. Bd. Can., Prog. Repts. Atlantic Coast Stas.
Fish. Res. Bd. Can., Prog. Repts. Pacific Coast Stas.
Fishing Gazette
Food Engineering
Food Manufacture
Food Packer
Food Preservation Quarterly
Food Processing
Food Research
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Food Technology
Frosted Food Field
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Industrial Refrigeration
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Journal of Biological Chemistry
Journal of Nutrition
Journal of the American Chemical Society
Journal of the American Dietetic Association
Journal of the American Oil Chemists' Society
Journal of the Association of Official Agricultural Chemists
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Journal of the Science of Food and Agriculture
Maine Coast Fisherman
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Modern Refrigeration
National Fisherman
National Provisioner
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Nutrition Reviews
Pacific Fisherman
Poultry Science
Progressive Fish-Culturist
Quick Frozen Foods
Refrigerating Engineering
Report of the Food Investigation Board (Great Britain)
Science
Seafood Merchandising
Trade News (Fisheries Department, Canada)
Western Fisheries
World Fisheries Abstracts
World Fishing

Articles chosen for abstracting or inclusion as bibliographical references are those deemed of interest to the commercial fisheries and to fishery technological laboratories. Occasionally pertinent articles from sources other than the above-listed publications are included. Biological papers are generally omitted.

3.12 USE OF ASCORBIC ACID FOR FISH PRESERVATION. ANALYTICAL DETERMINATION

Di Fabio, Maria Carusi (Lab. chim. prov., Pescara, Italy)
Progr. vet. 11, 876-80 (1956)
Chemical Abstracts 52, 18950 (November 10, 1958)

Favorable results for preserving fish meat by ascorbic acid are reported. Methods of detection and determination are reviewed briefly.

3.12 ANTIBIOTIC USE IN FISH PRESERVATION. IV. CHEMICAL RESEARCH ON ACRONIZE-TREATED SARDINES

Sebastio, Cosimo (Lab. chim. prov., Pescara, Italy) and Caracciolo, Stefano
Atti soc. ital. sci. vet. 11, 612-17 (1957)
Chemical Abstracts 52, 18950 (November 10, 1958)

Values for sardines of pH, volatile N bases, solution N, amine N + NH_3, and NH_3 indicate that after treatment with chlortetracycline the fish can be stored for an additional 12 to 60 hours at room temperature or for an additional 72 to 168 hours at ice temperature, as compared with untreated samples.

3.19 EFFECTS OF COBALT-60 γ-RAYS ON WATER, VARIOUS SOLUTIONS, AND AQUEOUS EXTRACTS OF FISH MEATS

Osakabe, Isami and Yamashita, Hisao (Tokyo Univ. Fisheries)
Radioisotopes (Tokyo) 6, 26-32 (1957)
Chemical Abstracts 52, 18949 (November 10, 1958)

Amounts of H_2O_2 produced in solutions of chlorides and sulfates by irradiation were less than that in pure water, whereas larger amounts were produced in dilute solutions of glucose, sugar, and agar agar, accompanied by a definite decrease in pH. The aqueous extract of irradiated and non-irradiated samples of fresh fish meats and their products showed no significant differences with respect to pH, amounts of H_2O_2, and free amino N.

3.19 EFFECTS OF COBALT-60 γ-RADIATIONS ON THE CONSTITUENTS OF FISH PASTE PRODUCTS

Urakami, Chieko and Kameyama, Haru
Rept. Sci. Living, Osaka City Univ. 5, 13-20 (1957)
Chemical Abstracts 52, 18950 (November 10, 1958)

3.2493 INCREASE OF VOLATILE BASIC NITROGEN AND GROWTH OF BACTERIA IN THE MUSCLE OF FISH AT THE EARLY STAGE OF SPOILAGE

Horie, Susumu and Sekine, Yutaka
J. Tokyo Univ. Fisheries 41, 69-74 (1954)
Chemical Abstracts 52, 14889 (September 10, 1958)

Experiments designed to determine the relation between the number of bacteria in spoiling fish and volatile basic N values showed that bacteria develop relatively slowly in the muscle even when N values are high and decomposition is taking place.

3.2493 CHANGES OF FAT IN FROZEN MACKEREL DURING STORAGE

Mel'nikova, O. M. and Khalina, N. M.
Inzvest. Tikhookean. Nauch. -Issledovatel. Inst. Rby. Khoz. i Okeanograf. 42, 299-302 (1954)
Referat, Zhur., Khim. Abstr. No. 31180 (1956)
Chemical Abstracts 52, 18950 (November 10, 1958)

Hydrolysis and oxidation of fat occur vigorously in mackerel stored at -8° to -10°, but not at -40° to -50°. Heat has very little effect on extent of hydrolysis of glycerides during sterilization, but it decomposes unstable peroxides to hydroxy acids and aldehydes. This explains the increase in organoleptic defects during the canning of fat fish.

4.91 EXPERIMENTAL STUDIES ON DIETARY FATS, CHOLESTEROL, AND ATHEROSCLEROSIS

Stamler, Jeremiah (Chicago Board of Health, Chicago, Illinois)
Food Technology 13, 50-57 (January 1959)

A total of 47 references are cited.

4.91 CLINICAL AND EPIDEMIOLOGICAL OBSERVATIONS ON THE INFLUENCE OF FATS IN THE DIET

Stare, Fredrick J. (Harvard University School of Public Health, Boston, Massachusetts)
Food Technology 13, 33-36 (January 1959)

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7.42 DETECTION OF METALLIC IONS OF SEVERAL FISH EYEBALLS BY PAPER CHROMATOGRAPHY

Wakui, Kesami; Mizote, Sonoko; and Tokuue, Kazuhiro (Hoshi Coll. Pharm., Tokyo)
Hoshi Yakka Daigaku Kiyo 7, 6-9 (1958)
Chemical Abstracts 52, 14875 (September 10, 1958)

From the ashes of Seriola quinqueradiata, Parapristipoma trilineatum, Euthynnus pelamys, Thunnus thynnus, and T. alalunga were found. Zn^{++}, Cd^{++}, Cu^{++}, Mn^{++}, Cr^{+++}, Ni^{++}, Al^{+++}, Mg^{++}, Ca^{++}, Sr^{++}, Na^{+}, and K^{+} in all cases.

7.42 TITRIMETRIC ANALYSIS OF CALCIUM AND MAGNESIUM IN MUSCLE

Gilbert, Daniel L. and McGann, JoAnna (Albany Med. Coll., Albany, N. Y.)
Proc. Soc. Exptl. Biol. Med. 97, 791-3 (1958)
Chemical Abstracts 52, 15626 (September 25, 1958)

7.53 DETERMINATION OF FAT IN FISH MEAL BY REFRACTOMETRY

Treiber, H.
Fette, Seifen, Anstrichmittel 60, 488-90 (1958)
Chemical Abstracts 52, 18951 (November 10, 1958)

Fish meal, 1.9 to 2.1 grams, is triturated with 3 ml. 1-cholornaphthalene, allowed to stand for 10 minutes, filtered, and n determined at 20°. The weight of fat (mg.) = E = 3581.4 x (1.6331–n)/(n 1.4760), and percent fat = E x 100/wt. of sample. The results agree well with fat determinnations by the solvent-extraction method.

7.53 FISH MEAL. INVESTIGATION OF FAT CONTENT

Luijpen, A. F. M. G.; Hooghiemstra-Brasser, D.; Hindriks, A. C.
Fette, Seifen, Anstrichmittel 60, 951 (1958)
Food Manufacture 34, 36 (January 1, 1959)

Gravimetric methods were compared with the titration of fatty acids for the determination of the fat content of fish meals. Acetone extraction before and after acid hydrolysis gave greater yields than carbon tetrachloride extraction after acid hydrolysis. Acetone extraction also gave greater yields than the method of Berntrop with one pre-extraction.

7.591 MICRODETERMINATION OF PROTEASE BY MEANS OF PHOTOGRAPHIC FILM TECHNIQUE

Watanabe, Ken; Yoshikawa, Mitsuyoshi; and Nonoguchi, Toshitaka
Hyogo Noka Daigaku Kenkyu Hokoku 3, 58-60 (1957)
Chemical Abstracts 52, 18615 (November 10, 1958)

A few μl. of protease solution is applied on a paper strip, the paper is covered with a photographic film (previously exposed to light and developed) and a glass slide, and placed on a filter paper soaked with buffer solution in a petri dish; then the assembly is incubated at 30° for 2 hours. When film is washed with cold H_2O, protease is detected as a clear spot of liquefied gelatin film. The area of the liquefied spot is proportional to the activity of protease.

7.591 STUDIES ON THE SUCCINIC DEHYDROGENASE OF FISH I. DETERMINATION OF SUCCINIC DEHYDROGENASE ACTIVITY IN FISH ORGANS WITH 2,6-DICHLOROPHENOLINDO-O-CHLOROPHENOL

Fukuda, Hironari
Bulletin of the Japanese Society of Scientific Fisheries 23, No. 9, 547-550 (1958) (English abstract and figures)

Enzyme activity is determined by measuring the rate of fading of the blue dye after adding the enzyme solution to a mixture of the other components of the reaction system. One unit of succinic dehydrogenase activity is defined as the activity capable of reducing the color intensity of the dye by 0.1 of optical density after 30 seconds in the initial stage of the reaction under the stated conditions.

8.51 MUSCULAR PROTEINS OF FISH, STRIATED MUSCLE OF THE CARP

Hamoir, G. (Univ. Liege, Belg.)
Arch. intern. physiol. et biochim. 63, Suppl. 1-152 (1955)
Chemical Abstracts 52, 18922 (November 10, 1958)

By the extraction of white and red muscle of Cyprinus carpio with phosphate solutions of ionic strength 0.15 and pH 7.7, a mixture of proteins can be isolated that is easily separable into albumin and globulin fractions by prolonged dialysis against water.

8.51 PLASMA PROTEINS OF FRESH-WATER FISHES (BARBUS FLUVIATILIS) AND LEUCISCUS CEPHALUS)

Mestres, J. Planas and Gras, J. (Hosp. Municipal de Infecciosos, Barcelona, Spain)
Rev. espan. fisol. 13, 17-24 (1957) (English summary)
Chemical Abstracts 52, 14015 (August 25, 1958)

Values obtained by $Na_2S_2O_3$ fractionation of serum proteins from these fishes disagree with those obtained by paper electrophoresis.

8.51 SOME NOTES ON M-ACTOMYOSIN OF SQUID MUSCLE

Matsumoto, Juichiro J. (Tokai Regional Fisheries Research Laboratory)
Bulletin of the Japanese Society of Scientific Fisheries 24, No. 1, 29-36 (1958) (In English)

The salting-in range of M-actomyosin of squid was found to be similar to the range for rabbit and carp actomyosins.

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